VOL. XIII. No. 10 OCTOBER 1928

MECCANO MAGAZINE

A GIANT CABLE-LAYING MACHINE.
(See page 786.)

6D

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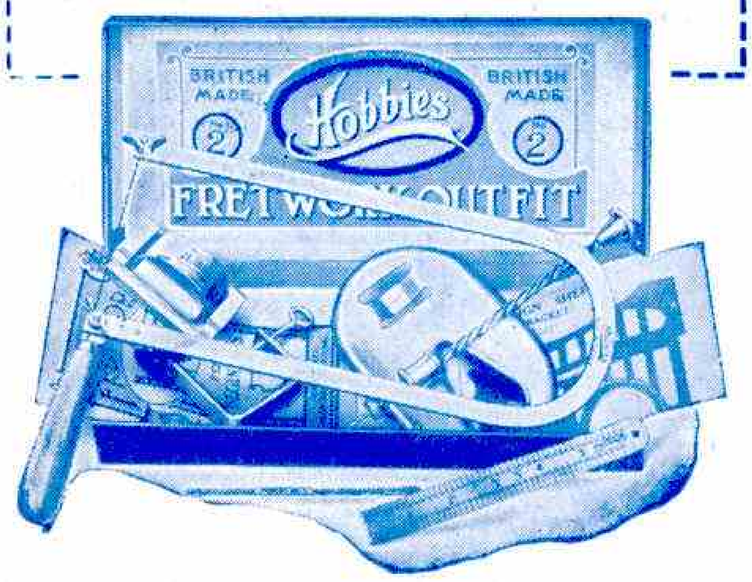

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MECCANO MAGAZINE

Editorial Office:
Binns Road
Liverpool

Vol. XIII. No. 10
October, 1928

With the Editor

Another Milestone

On page 828 of this issue will be found the most interesting announcement that has been made by Meccano Limited since 1919, when, in the "*M.M.*" for September-October, the establishment of the Meccano Guild was announced.

The Meccano Guild resulted from the urgent demand of Meccano boys all over the world for a central organisation that would bring them together in one great brotherhood and help them to get the utmost possible amount of fun from their Meccano Outfits. The fact that the Guild filled a real want was shown by its instant success. It provided something of which thousands of boys had dimly realised they were in need, and from its announcement up to the present day it has grown rapidly and with an unbroken steadiness that is perhaps unique among international organisations. The Guild numbers 76,300 members, and upon this firm foundation there have sprung up in all parts of the world over 300 Meccano Clubs, the members of which are drawn together by enthusiasm for their hobby—Meccano model-building. The members of these clubs meet together regularly and, by combining their inventive skill and enthusiasm, obtain a far greater amount of pleasure from their hobby than if they worked alone.

In 1920 there came into being the Hornby Railway System. At first this was on a very small scale, but new locomotives, rolling stock, points, crossings and accessories of all kinds were added rapidly until the system became a real railway in miniature. This new development was greeted with the utmost enthusiasm and it was not long before history repeated itself. Letters began to reach us in ever-increasing numbers expressing the hope that there would be formed an organisation of a similar nature to the Meccano Guild but devoted entirely to the interests of Hornby Train users.

At the time it was not possible for us to undertake this great task in addition to maintaining the Meccano Guild organisation, and until recently all that could be done was to encourage the formation of Hornby Railway Sections of Meccano Clubs, to meet under special sub-Leaders of their own. One by one the various difficulties have been removed, however, and this month we are able to announce the inauguration of the Hornby Railway Company, under the Presidency of Mr. Frank Hornby. The main object of this Company is to assist every owner of a Hornby Railway to develop his layout on the most realistic and railway-like lines and to extract every possible ounce of fun from his hobby.

Join the Hornby Railway Company!

Every boy who possesses a Hornby Train is eligible to become a member of this great Company and to wear a special badge, beautifully enamelled in colours, and having as its central feature a tiny representation of a train. Every member will have at his disposal the advice of an expert staff at Headquarters, whose task it will be to solve the problems and difficulties that he may encounter from time to time and to assist him in every possible manner. In addition, through the medium of the Hornby Railway Correspondence Club, each member may be placed in touch with one or more model railway enthusiasts in any part of the world. Members will thus be able to exchange news and opinions upon all aspects of model railway working, and also to exchange photographs both of miniature and real railways.

Another and even more important branch of the work of the Hornby Railway Company will be the formation and development of Branch Companies which, when properly established, will be incorporated in the parent Company. These Branch Companies will be operated as nearly as possible upon the lines of real railways and will open up an entirely new field of fun and interest.

Further important announcements regarding the Hornby Railway Company will be made in the "*M.M.*" during the next two or three months, and I strongly advise all readers to keep in close touch with developments. Commencing next month a special section of the Magazine will be devoted to miniature railway working in general and to the Hornby Railway Company in particular. This section, of the greatest possible interest and value to all owners of miniature railways, will cater equally for the beginner and the expert.

Burrowing Underground

In the wilder parts of the earth there are still a few isolated and backward races who live in caves or in holes dug in the ground. A notable instance of this is the existence in Algeria of a tribe who live in underground houses. They have developed their strange dwellings to a standard of comfort far beyond that of prehistoric times, but the survival is a reminder of the days when man was a burrowing animal.

It is perhaps some dim race-memory of cave life that makes us burrow underground without hesitation, whenever an advantage is to be gained or the necessity arises. We descend into the earth in search of metals and coal, and it seems quite natural to drive tunnels under large cities in order to relieve traffic congestion or when other methods of communication offer difficulty. Railway engineers, for instance, avoid costly detours and severe grades by boring through hills and mountain ranges, while tunnels offer the best method of overcoming, or rather undercoming, such obstacles as rivers and estuaries. The result is that there is nearly always some great tunnelling project being carried out somewhere in the world.

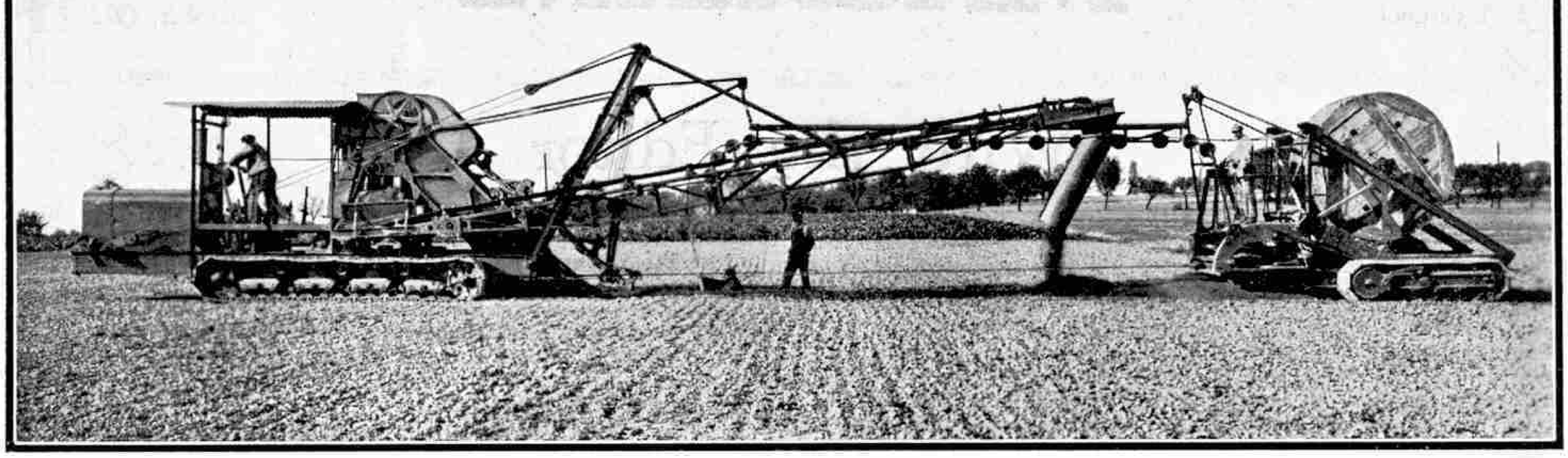
Even more important than such engineering triumphs as the tunnels through the Alps or the Rocky Mountains, are the possibilities that lie before us. From an engineering point of view there is now no great difficulty in tunnelling. The experience that has been gained since 1798, when the first unsuccessful effort to burrow under the Thames was made, has led to the adoption of methods of cutting and draining of such efficiency that the mere length of these works is now a minor consideration.

If suitable rock strata exist at a reasonable depth it is possible to bore a comparatively dry highway under any river or estuary that now presents an obstacle to rapid and easy communication. This is proved by the fact that engineers have long regarded the Channel Tunnel as feasible. Work on this undertaking was actually begun both in England and in France, and the construction would have been completed years ago but for political considerations. There is still a prospect that some day the work will be completed. Then Great Britain will be an island in a geographical sense only, as railway and road communication will replace the Channel crossing. If the tunnel were completed the tourist traffic between Great Britain and the rest of Europe would be enormously increased and the cost and labour of transporting goods considerably reduced.

Looking further afield it is significant that a Channel Committee exists in Spain as well as in England and France. The members of the Spanish Committee have already expressed themselves in favour of the construction of a tunnel to connect Gibraltar with Africa. This would undoubtedly lead to the building of a railway across the Sahara desert and to a considerable extension of other African railways also. Every part of the great continent would thus be placed in direct communication with London. Some of us may yet be able to witness the departure from a London terminus of the "*Golden Rand Express*," with through sleeping carriages for Uganda and the Gold Coast.

Cable-Laying by Machinery

Reducing Underground Transmission Line Cost



ONE of the chief problems that arise in the extension of the use of electric light and power on a large scale is that of securing safe and economical means of transmission. The tendency to-day is to concentrate on the construction of fewer and larger generating stations from which high voltage current shall be distributed over very wide areas. So far, for economical reasons, overhead cables have been largely used in preference to underground cables. Underground transmission lines have many undoubted advantages but the cost of laying them has proved prohibitive in very many cases.

The chief causes of the heavy cost of underground lines are the enormous number of men required for the various operations of digging and re-filling the trenches, and the slow progress of the work. Further difficulties are met with when it is necessary to lay the cables under the pavements of city streets—and the inconvenience of the almost unavoidable disturbance of traffic must also be reckoned with.

The cable carrier, showing how the cable unwinds from the drum and passes along the overhead line of pulleys. The illustration at the top of the page shows the excavator hauling the cable carrier, both being fitted with caterpillar tracks

In this connection we may recall the work that first brought fame to Sir Charles Tilston Bright, the famous engineer who laid the earliest Atlantic cables. When still only 21 years of age he was called upon to superintend the laying of the great lengths of underground cable necessary to extend telegraphic communication from London to the north of England and thence to Scotland. The nature of the methods then in vogue may be realised from the following quotation from the interesting life of the great engineer by his son, Sir Charles Bright, F.R.S.E., M.Inst.C.E., M.I.E.E.

"The following arrangements for the night's work go to show the prescience and energy characteristic of him. A large number of navvies were engaged, with competent foremen. To each gang was assigned a given length of street, along which the flagstones were to be lifted, the trench opened to the requisite depth, and the under-halves of the pipes laid and linked at the bottom. Another gang at once followed, wheeling the drum (whose breadth exceeded that of the trench), and unwinding the rope of wires into the under-halves of the pipes previously laid down. A further gang followed for applying, linking, and tightening the upper halves of the pipes, while yet another set of men filled up the trench and replaced the flags. This operation, though easily described, required at this early stage of telegraphy a great deal of consideration, coupled with very active and determined control throughout the short night."

Night work was at times necessary in order to avoid disturbance of traffic as far as possible. From the same source we quote the following description by Bright himself of the activity and excitement that prevailed on this occasion.

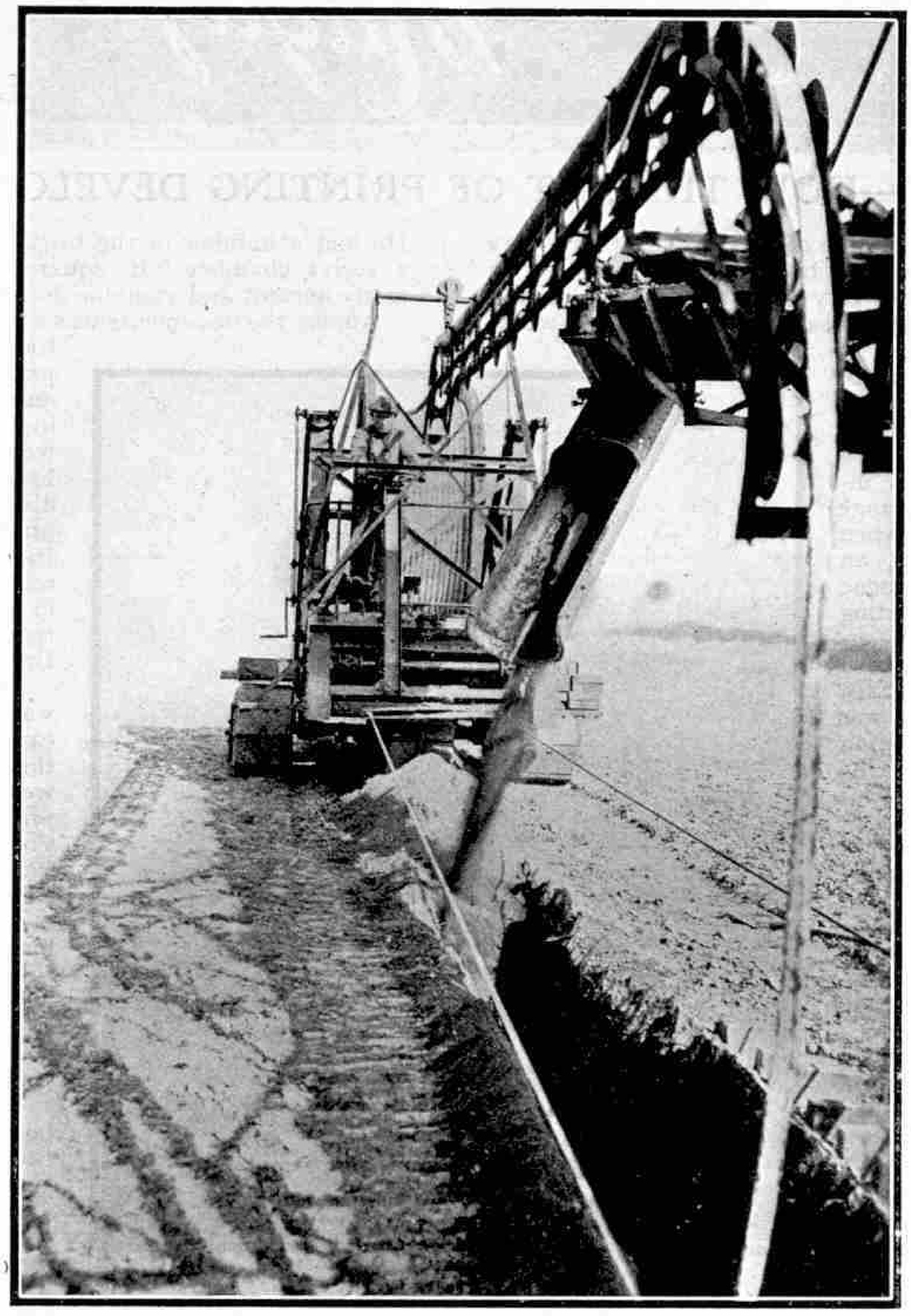
"Last night I did the quickest piece of telegraphic work which has ever been done. We began at ten, and by eight in the morning we had laid piping containing eight wires under the streets nearly half a mile, and all repaved.

"Can you fancy such a scene? A long row of men with pick-axes, followed by others with spades, and after them a gang of men laying pipes and wires, and, to conclude, another set relaying the paving-stones. This row of workmen are lighted up by large fire-grates at intervals, flaring and smoking away like beacons on the coast —a perfect Babel of voices — the continual sharp knocking of the pickaxes and the scraping and clanging of the pipes being laid and hammered up, added to continued shouting for this or that tool. If you can conjure up this, you can fancy my figure appearing in the light here and there with two or three foremen—quite in my element, only I don't like the night!"

Very little improvement was effected in the years following Bright's experiences and manual labour remained the chief agent both for digging trenches and actually laying down the cable. There now appears to be a reasonable prospect of this state of affairs coming to an end. A well known German firm, the Eisenwerk Weserhütte A.-G. of Bad Oeynhausen, in Westphalia, has produced an efficient and comparatively cheap machine that lays cables underground with the greatest ease. First of all this machine digs a trench, then lays the cable in it and finally replaces the excavated earth in the trench and rolls the surface down smoothly. This machine has passed successfully a series of exhaustive tests and has been in practical operation for some time at various places, notably near Zeitz.

This firm has had a long and wide experience in the design and manufacture of excavators and this experience was of very great value in designing the cable-layer. The machine consists of four main parts—a portable bucket excavator, mounted on a tractor equipped with a double caterpillar track; a band conveyor which refills the trench with earth behind the excavator by means of a rotating chute; a cable truck drawn by the excavator and carrying the cable drum; and finally the apparatus that lays the cable into the open trench behind the excavator.

One of the first essentials for this machine was that it should be capable of passing over all sorts of ground. This condition could only be accomplished by applying the caterpillars for the locomotion of the excavator and the cable truck and thus equipped these vehicles should be easily and safely manageable alike in service and transport. The excavator is mounted upon two lateral caterpillars. If the direction of motion is to be changed one or other of these caterpillars is braked in the manner usual with caterpillar vehicles. The underframe of the excavator is a strong steel construction and is mounted on axles supported by springs and connected on both sides to the lower wheels in the caterpillars in a perpendicular suspended cast steel roller frame. Owing to this special construction the machine fits closely into all irregularities of the ground and the pressure on the ground surface is perfectly distributed and does not exceed 5 lb. to the sq. in.



Cable-laying Machine at work. The cable may be seen entering the trench, and the excavated earth is being returned, ahead of the cable carrier, down the discharge chute

All transmission gears of the excavator are enclosed in oil boxes and most of the parts are made of tempered chrome-nickel steel or other steel of great strength and elasticity. By means of different gears the excavator is capable of eight different speeds. Of these four speeds are for locomotion and four for operating the excavator and the conveyors. This variability is absolutely essential in order to avoid undue strains on the gears. The excavator is thus enabled to advance when operating at speeds of 205 ft., 265 ft. or 305 ft. per hour; and when travelling free it can move at speeds of 1.63, 1.75 or 1.98 miles per hour. When the machine is reversing the operating speed is 190 ft. p.h. and the free speed 1.4 m.p.h. It is thus possible for the machine to lay 813 yds. of cable in a day of eight working hours.

The excavated earth is raised by the buckets into the housing at the top of the excavator where it is deposited on to a short transverse reversible conveyor which takes it to the main longitudinal conveyor. This main conveyor refills the dredger (*Continued on page* 825)

IV.—HOW THE ART OF PRINTING DEVELOPED

IN Europe up to as late as the middle of the 14th century every book and document was written by hand. The duplication of books thus was necessarily a very slow process, and although it sufficed to meet the limited demand during the period in which learning was confined to the few, it became altogether inadequate when, late in the 14th century, there began a great spread of interest in learning. During the early part of the 15th century the demand for books increased rapidly and the shortage reached an acute stage. Then, when the position was really serious, an inventive genius came to the rescue by introducing the method of printing by movable types.

Printing of a kind had already been in existence in Europe from the 12th century. The method used was known as block-printing, and was an extremely laborious process. The text or picture to be reproduced was marked out on the surface of a block of wood and the wood was then cut away so as to leave the required print standing up above the level of the rest of the block. The next stage was to wet the prepared block with a thin brown liquid somewhat resembling distemper. A sheet of damp paper was then laid upon the block and the back of this sheet was rubbed with a burnisher until an impression of the raised portion of the block had been transferred to the paper. Sheets prepared in this manner obviously could only be printed on one side, but sometimes the sheets were pasted back to back in pairs before binding so as to give the appearance of an ordinary book. As may be imagined, the production of a single issue of the *"Meccano Magazine"* by such a tedious method probably would have been the work of several years!

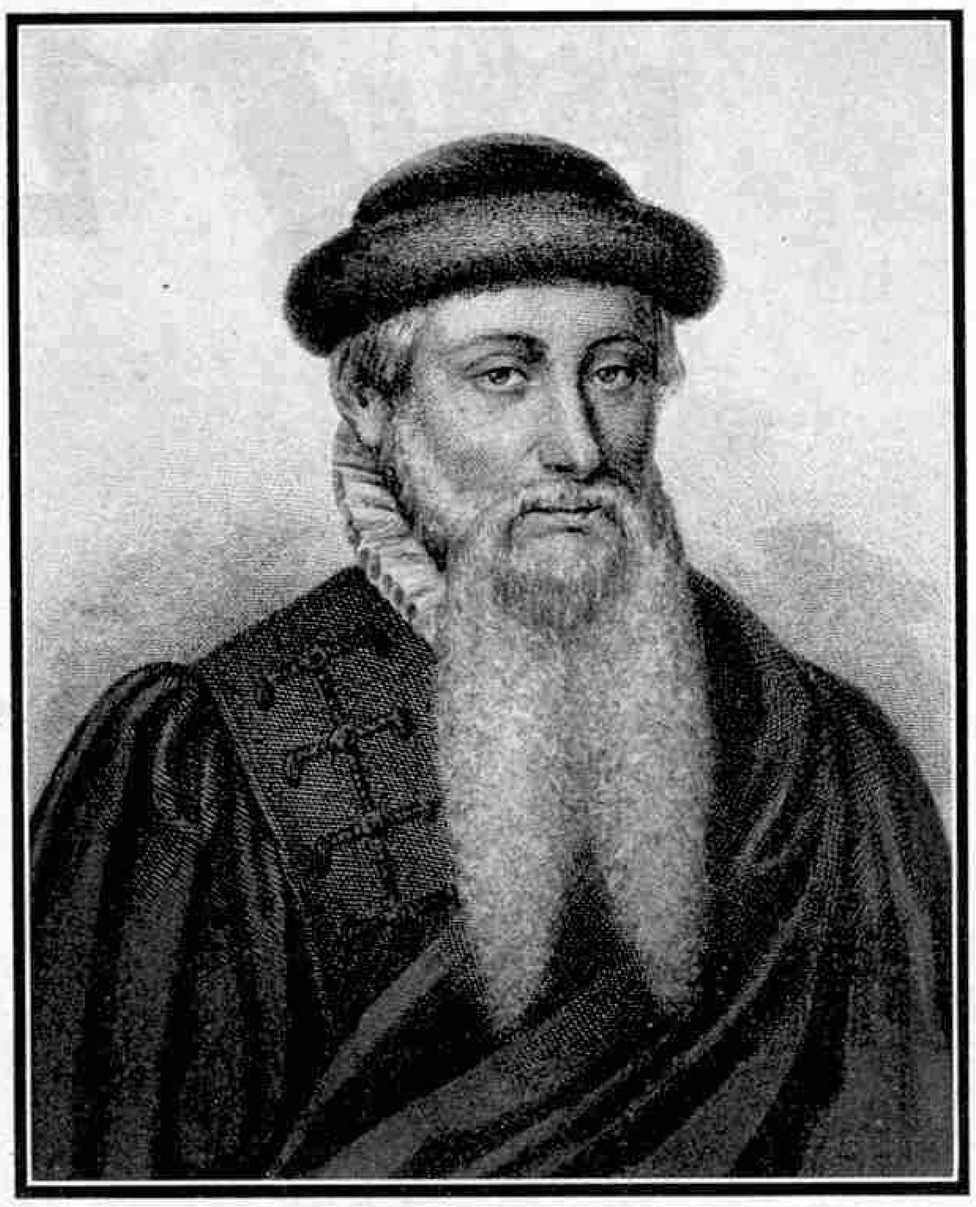
There is good reason for believing that the art of block-printing originated in China, and it is certain that the earliest printed book in existence was produced in that country. The story of the discovery of this book in recent years is of great interest. In the far north-east of China is the Province of Kansu, stretching away over the mountains towards the arid desert of Gobi. Near the city of Tun-Huang in this Province are several large caves known as "The Caves of the Thousand Buddhas," in two of which are images of Buddha some 90 ft. in height. Some years ago a priest took upon himself the task of collecting money to be applied to the restoration of the carvings and decorations in these caves. One day, in dealing with an old fresco, he discovered that the work had been carried out on brick and not on stone in the usual manner. This naturally aroused the priest's curiosity. He had a number of the bricks removed and then was revealed a secret chamber 9 ft. square and 10 ft. in height, containing many ancient and valuable documents.

Among the documents was a roll that had been made by pasting together seven printed sheets. The printing was of better quality than any European work previous to the invention of movable types, and it was described as "Printed on May 11th, 868, by Wang-Chieh, for free distribution." The subject of this printed matter was a section of the Buddhist scriptures particularly esteemed in China, and it was printed in both Sanskrit and Chinese characters. This document is now in the British Museum.

There is little doubt that learning was developed in China at a far earlier period than in Europe. It is therefore not surprising that printing was first introduced in China and it is probable that paper was invented there also. As far back as the year 175 standard texts of the religious classics of China are said to have been cut in stone and the practice of making impressions from these cuttings began soon afterwards. Some 200 years later ink made from lampblack came into use and this is still employed to-day under the name of Indian ink.

The story of modern printing may be said to date from the middle of the 15th century, when movable types were brought into use in Europe. The main feature of the invention was the substitution of single letters for blocks the size of a page, together with a means for arranging the letters to form the desired text. The outstanding advantage lay in the fact that a page of movable type could be broken up and the letters distributed and used again, whereas the blocks previously employed could only be used for reproducing the text or picture originally cut in them.

The introduction of movable types was a great stride forward and it is rather curious that the early history of such an important invention should be so very obscure. Actually there have been four claimants for the honour in Europe, while yet another appeared in China. Of these five, the Chinese claimant, Pi-Sheng, was much the earliest. He used movable types of a kind as early as 1041, some 400 years before the European invention. He made his types by cutting characters in sticky clay, which was afterwards hardened by baking. The types were assembled for use in an iron frame and the compositor sat between two revolving tables having compartments for the large number of types necessary for printing in Chinese characters. As might be



Johann Gutenberg

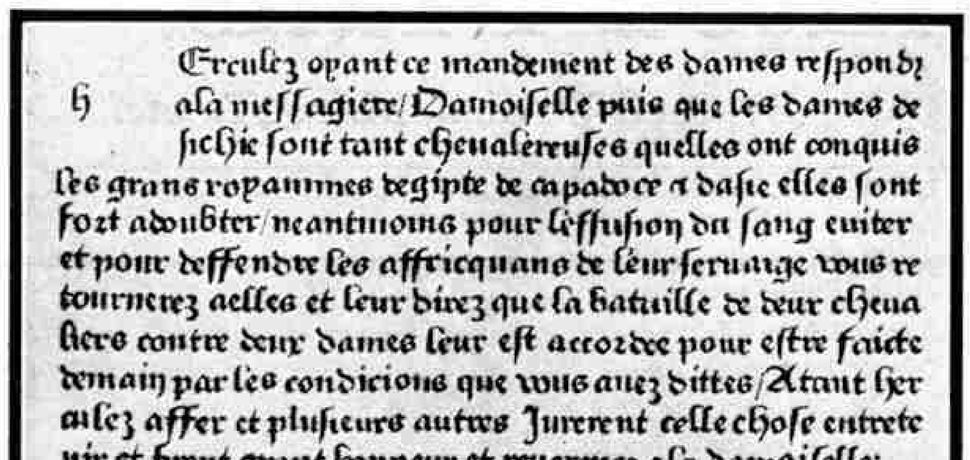
The previous articles have explained those operations in the production of the "Meccano Magazine" that are carried out in the editorial offices. When the copy is prepared and the illustrations are chosen, the printing and block-making processes necessary for the actual production of the Magazine follow, and in this and succeeding articles it is proposed to deal with this fascinating side of the work.

Printing will be taken first, and in order to enable readers to appreciate the wonderful methods that are used in modern high-class printing we shall trace the story of this important art from the days when such a Magazine as the "M.M." was not only impossible, but absolutely undreamed of.

expected from the nature of the material from which these types were made, the method did not come into extensive use. At a later period types made from tin were tried, but these also proved unsatisfactory and were subsequently superseded by wooden types. Specimens of wooden types made about 1300 were discovered in the "Caves of the Thousand Buddhas" already mentioned.

At a still later period types made from easily fusible metal were introduced and the greatest use of these was made in Korea. It is difficult for us to-day to imagine the Koreans as anything but a subdued and illiterate race, but at the time of which we are speaking they were an independent nation of great power. In 1390 the Korean ruler gave orders for the establishment of a type-founding plant and there is still in existence a book that was printed in Korea from movable metal types in 1409—almost 50 years before the invention of movable types in Europe.

It is fairly certain that the invention in Europe of printing from movable types was made quite independently of Far Eastern developments. It is probable that the honour belongs to Johann Gutenberg of Mainz, although there were several rival claimants, chief among whom was Coster of Haarlem. Coster's claim is based upon the existence of certain books that were printed in Haarlem earlier than any produced in Mainz, but it is by no means certain that Coster actually printed these books. The name of Gutenberg has therefore always been definitely associated with the discovery, and the production of books printed from movable types at Mainz in 1454 may safely be regarded as the real starting point of printing in Europe.


Ercules opant ce mandement des dames respondy
ala messagiere/Damoiselle puis que les dames de
sichie sont tant cheualereuses quelles ont conquis
les grans royaumes degipte de capadoce a dasie elles sont
fort adoubter/neantmoins pour leffusion du sang euiter
et pour deffendre les affricquains de leur seruage vous re
tournerez aelles et leur direz que la bataille de deux cheua
liers contre deux dames leur est accordee pour estre faicte
demain par les condicions que vous auez dittes/Atant her
ales affer et plusieurs autres Jurerent celle chose entrete
nir et furent grant honneur et reuerence ala damoiselle:

WHan Jasius sawe hys broder come all in ar-
mes. all his bloody began to chaunge. a seeyng
that his broder was esmeuyd a full of euyll
will demyng that this mater sholdy tome to grete myf
chief. he aseried and saide Alas what auayleth for to
speke and counceyll a seke menes of pees betwene my
broder a me. we ben betrayed. lo here is my broder that
cometh vpon vs all in armes. echa mān saue hym self
that may With these wordes Dardanus amyn to the
anshstorie smote his broder vnto p deth a said Jasius
thou maist not abstayne thi self from thy machynacy-
ons Thou hast enhaunsed thy self ayaust me. but now
y shal make an ende of the Jasius fill down dedy among
the feet of hys frendes And ther Clothes were all be
sprent a le bledy of his bloody Whan the frendes of Jas
ius saw this tyrannye they saued them self as well
as they coude to their power and fledy from thens all
aragedy Than Dardanus retomedy to the riall palays

A reproduction of the French and English editions of "The History of Troy" printed by Caxton

Gutenberg's career, like that of many other inventors, was somewhat thorny. His troubles began at the age of 10 when his family were expelled from Mainz in a popular tumult. They took refuge at Strassburg and there during the next few years Gutenburg tried a great variety of schemes in the hope of making a fortune. He began to experiment on printing methods about 1436. He seems to have mastered the problem of using movable types between 1444 and 1448, when he was residing in some unknown place. A proof of this is that fragments exist of a calendar that astronomers consider was intended for the year 1448, while other small sheets exist that have been printed from type of a cruder kind than that of the calendar.

Gutenberg was always short of money and thus was compelled to work in partnership in order to raise the necessary funds. This practice led to all kinds of troubles and difficulties, including lawsuits. One citizen of Mainz named Fust was for a while particularly active in assisting Gutenberg, who had returned to his native city in 1448, but eventually he lost patience as the result of continued calls for more and more money. Finally he demanded the return of his money, and as he did not get it he compelled the inventor to yield up the whole of his printing materials. The unfortunate man was thus left penniless and without his printing press. He succeeded in obtaining further assistance and in commencing printing once more, but he never attained any financial success and was in straitened circumstances to his death in 1468.

An old woodcut illustrating an early type foundry showing furnace and bellows and a worker casting type

The first book printed by Gutenberg was produced in 1454 while he was in partnership with Fust, and it was a copy of "Letters of Indulgence" issued by the Pope. Indulgences were pardons granted by the Pope and in the 15th and 16th centuries they were openly hawked about for sale, an abuse that played a large part in bringing about the Reformation. Gutenberg printed two sets of these, in 1454 and 1455, which were issued for the purpose of raising money to aid the King of Cyprus to defend his kingdom from the Turks, who had just captured Constantinople and were threatening that monarch.

Two years later Gutenberg printed the Latin Bible now known by his name. Other names given to this famous book are the Mazarine Bible and the 42-line Bible, the latter name referring to the number of lines in each of the two columns on a page. It is probable that Fust lent money to Gutenberg to assist him in producing this Bible, the first large book to be printed by the new method.

A third interesting book of this period was a Psalter or Book of Psalms published in 1457, which is remarkable as being the first printed book to bear the names of the printers, in this case Johann Fust and Peter Schöffer. Much of the doubt concerning the identity of the inventor of movable types would have been avoided had this practice been instituted earlier. Fust was Gutenberg's former partner while Schöffer was the man who operated Gutenberg's press after Fust had seized it and removed it to his home. Their Psalter was a splendid production, and the printing office of Fust and Schöffer was of great importance during the remainder of the 15th century.

The first printer in England was William Caxton. This remarkable man established himself early in life at Bruges, where he prospered greatly. Subsequently he was employed on various diplomatic missions by Edward IV and was thus brought into contact with the Court of the Duke of Burgundy, in whose dominions Bruges was situated.

The Duke had married Margaret, the sister of Edward IV, and it is largely from her that the impulse was given that resulted in Caxton becoming the first English printer. Much of the latter's spare time had been spent in reading and he never picked up an interesting book without wishing to translate it into English. Among other books one dealing with the stories of the siege of Troy specially attracted his attention and he commenced an English rendering of it.

The difficulties of the task deterred him somewhat and he abandoned it after translating a few pages. When the Duchess heard of this at a later period she urged him to continue and offered to assist him. Accordingly he entered the service of the Duchess in 1471 and received a yearly pension while continuing his literary studies.

Caxton seems to have been forced into printing as a means of supplying the number of copies of his books that were asked for and he probably learned the new art during a short visit that he paid to Cologne. He refers to his reasons for commencing printing, in a passage included in his translation of the stories of the siege of Troy.

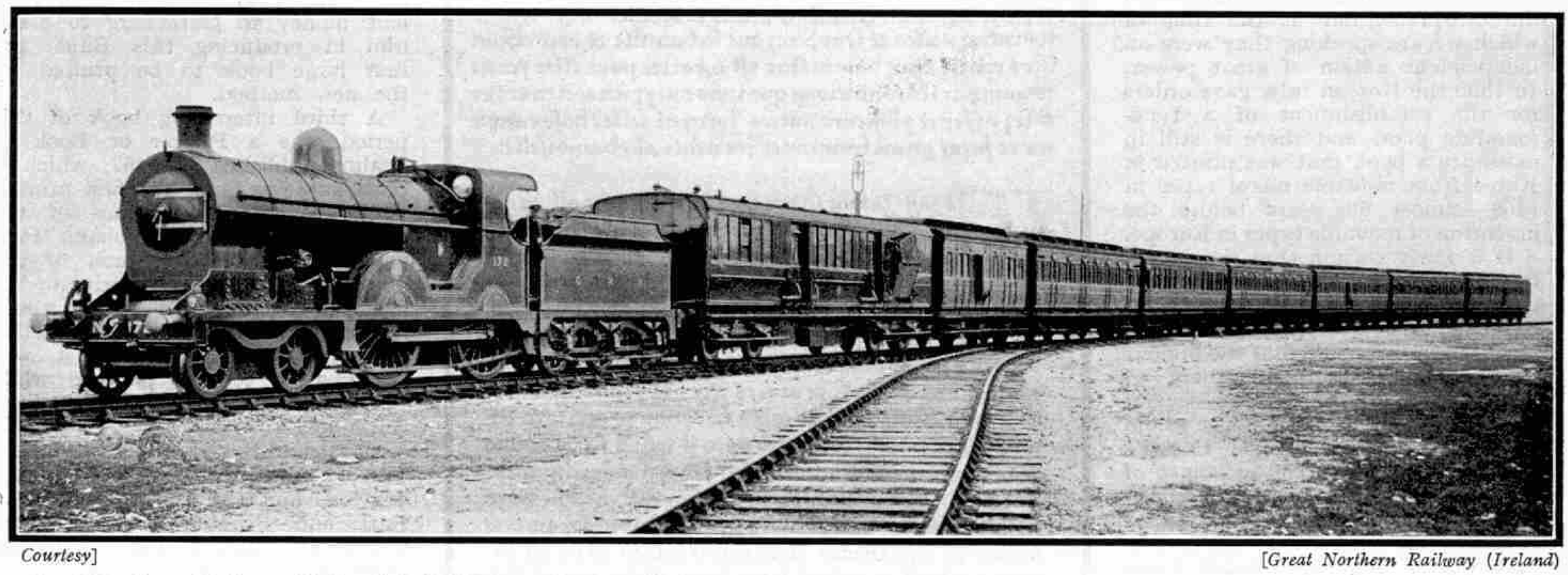
"Thus end I this book," he writes, "and for as much as in the writing of the same my pen is worn, mine hand weary and not steadfast, my eyes dimmed with overmuch looking on the white paper, and my courage not so prone and ready to labour as it hath been, and that age creepeth on me daily and feebleth all the body; and also because I have promised to divers gentlemen and to my friends to address to them as hastily as I might this said book, therefore I have practised and learned, at my great charge and expense, to ordain this said book in print, after the manner and form as you may here see; and is not written

(Continued on page 808)

FAMOUS TRAINS: XXII.

The "Limited Mails" of Ireland

By Cecil J. Allen, M.Inst,T., etc.



Courtesy [*Great Northern Railway (Ireland)*

Great Northern Railway (Ireland) 4–4–0 locomotive No. 172, "*Slieve Donard*," at the head of the Belfast-Dublin "Limited Mail" Express

LAST month the "*Irish Mail*" carried us from London to the Anglesey coast at Holyhead, and the intervening weeks have doubtless proved sufficient for us to pick a fine day and brave the terrors of the Irish Sea on the way across to what was once "Kingstown," but is now, in the Erse of the Emerald Isle, "*Dun Laoghaire*." As I told you last month, the name of the Irish port need not frighten you; say "*Dun Lairy*," and you will be understood at once. Dun Laoghaire is almost a suburb of Dublin, being only six miles from the heart of the Irish capital. It is finely situated on the south-west side of the broad Dublin Bay, backed up by the bold outline of the mountains of Wicklow, the highest of which—Lugnaquilla—attains to 3,039 ft. above the sea.

The pier at Dun Laoghaire, on which stands the Pier Station, stretches well out to sea, and on it we find the trains waiting to carry through passengers to all parts of Ireland. There are the brown varnished teak coaches of the Great Northern Railway, destined northward for Belfast; the blue coaches of the one-time Midland Great Western Railway, to cross the country to Galway in the west; and the teak coaches of the pre-grouping Great Southern and Western, on their way south-westward to Cork. The two last-mentioned railways, with the Dublin and South Eastern Railway—to whom the Dun Laoghaire Station belonged and by whose locomotives and lines we obtain access to Dublin—have now all been fused to form the Irish Great Southern Railway. The Great Northern Railway, partly situated in the Irish Free State and partly in Ulster, remains an independent company.

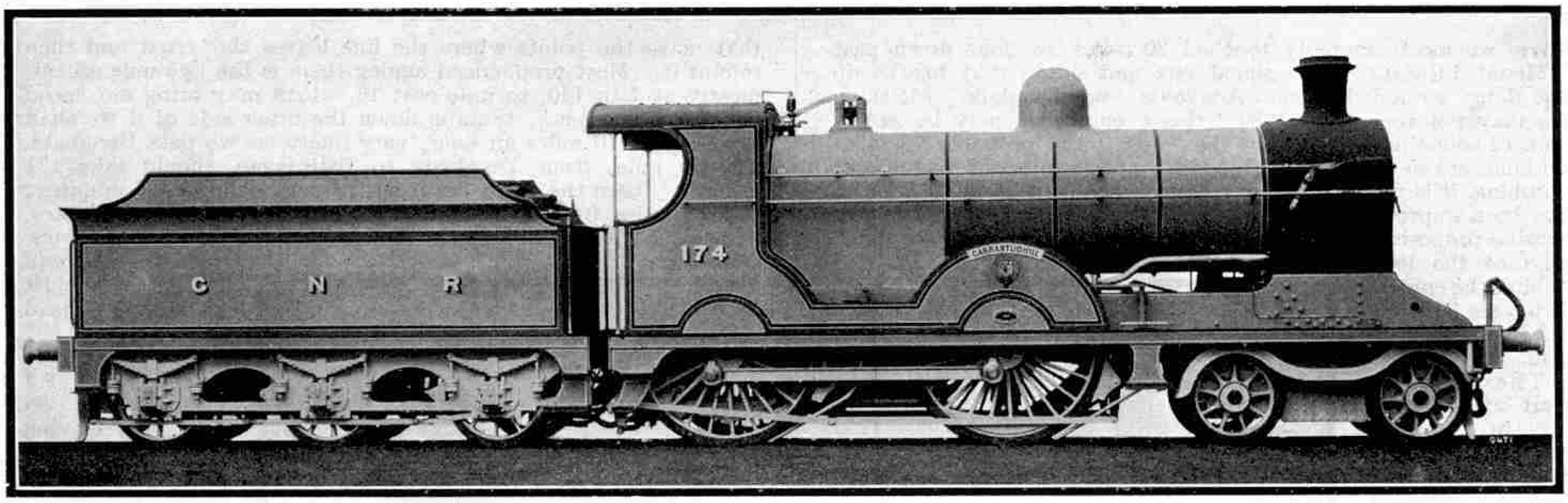
All three through portions just mentioned are to go forward from Dublin by "Limited Mail" trains. The Great Northern portion is usually worked in separately, but the Galway and Cork sections travel together, all of them leaving just after 6 o'clock in the morning, directly after the arrival of the night steamer from Holyhead. The first thing that we notice about the stock is that it is of an external appearance and internal comfort quite equal to the best to be found in England. The second thing that catches our eye, probably, is that three passenger classes are still provided in Ireland, second class still surviving, as it does on the Continent of Europe. There is no sign of restaurant car accommodation, but we shall not have long to wait; restaurant cars will be found on each of the "Limited Mails" to which our through coaches will be attached at the Dublin terminal stations, and we may be sure of an admirable breakfast when the time comes. The third thing the expert eye will not fail to detect is that the gauge of the tracks is wider than that to which we are accustomed; actually it is 5 ft. 3 in., as compared with the standard British 4 ft. 8½ in.

Leading Dimensions of Express Locomotives used on Irish "Limited Mail" Express Trains

	Great Southern 4–6–0 Type 4-cylinder	Great Southern 4–6–0 Type 2-cylinder	Great Northern 4–4–0 Type 2-cylinder
Cylinders, diameter	14 in.	19½ in.	19 in.
,, stroke	26 in.	28 in.	26 in.
Coupled Wheels, diameter ...	6 ft. 7 in.	5 ft. 8½ in.	6 ft. 7 in.
Heating Surface, Tubes ...	1,614 sq. ft.	1,614 sq. ft.	975 sq. ft.
,, ,, Firebox ...	158 ,,	158 ,,	141 ,,
,, ,, Superheater	366 ,,	440 ,,	250 ,,
,, ,, Total ...	2,138 ,,	2,212 ,,	1,366 ,,
Firegrate Area	28 ,,	28 ,,	23 ,,
Working Pressure, per sq. in.	175 lb.	180 lb.	200 lb.
Tractive Effort (85% Wkg. P.)	19,300 lb.	23,780 lb.	20,200 lb.
Tender Water Capacity ...	4,500 gals.	3,850 gals.	2,500 gals.
,, Coal ,, ...	7 tons	8 tons	4 tons
Adhesion Weight	57 ,,	55½ ,,	34 ,,
Wt. of Engine in working order	76 ,,	74½ ,,	52 ,,
Wt. of Engine and Tender (Full)	118 ,,	116½ ,,	82½ ,,

The short journey of six miles into the Westland Row Station of the old Dublin and South Eastern Railway is the first break, and we then pass by the "City of Dublin Junction" line on through Tara Street and the centre of Dublin, across the Liffey, and into Amiens Street Station, which adjoins the Amiens Street terminus of the Great Northern Railway. Here the Belfast coaches are attached to the Belfast "Limited Mail," which is booked to start at 6.40 a.m. and to reach Belfast in the excellent time of 2½ hours for the 112½ miles, with four intermediate stops. The Galway and Cork coaches travel on from Amiens Street round the tortuous course of the old Midland Great Western line, alongside the Royal Canal, as far as Glasnevin Junction, where they separate, the former to be worked into Broadstone Terminus, reversing at Liffey Junction, and the latter into Kingsbridge, reversing at Island Bridge Junction, for the outgoing "Limited Mails" at 7.10 a.m. and 7.0 a.m. respectively. The former, which is the slowest of the three, takes 3 hrs. 40 min. to cover the 126½ miles from Dublin to Galway, while the latter is due in Cork, 165½ miles distant, at 10.55 a.m.

As the best locomotive running is generally performed on the up journeys, we will make for England, instead of getting farther away from home, and we must therefore imagine ourselves at the outward end of the "Limited Mail" journeys, ready to begin



Courtesy [*Great Northern Railway (Ireland)*

G.N.R. (Ireland) 4–4–0 locomotive No. 174 "*Carrantuohill.*" This locomotive was built by Beyer Peacock & Co. Ltd., Manchester, in 1913, and is one of a class of locomotives famous for their extremely smooth and quiet riding qualities

the journey back to Dublin. The rolling stock makes the double journey daily. Obviously we cannot be in two trains at once, and so we must take the necessary trips consecutively.

For the first trip, therefore, we present ourselves at the Great Victoria Street terminus of the Great Northern Railway in Belfast soon after five o'clock in the evening; our southbound journey is to commence at 5.30 p.m. The train is of no great weight. On the rear end we notice a slip coach destined for the seaside resort of Warrenpoint, on the coast of County Down, to be slipped at Goraghwood; then follow a large brake and a "tri-composite" coach for Dun Laoghaire, a third-class and a composite third and second-class, a composite restaurant car, second and third-class at one end and first-class at the other, with the kitchen between, and a first-class brake—seven coaches in all. The vehicles are of substantial build, weighing up to 33 tons apiece, so that the whole train scales about 220 tons, and with passengers and luggage 235 tons or so. This is not a tremendous weight according to our current notions in England, but some very heavy gradients are to be surmounted *en route*. Further, nothing heavier than a 4–4–0 locomotive is permitted over the Boyne Bridge, which we shall cross just before Drogheda, and the timings, as we shall see, are astonishingly fast.

Courtesy [*Great Northern Railway (Ireland)*

Amiens Street Station, Dublin. This station has three platforms and covers 8,398 sq. yards, roofed. Architecturally it might be in almost any part of the Empire, but the jaunting cars fix its home definitely as "Somewhere in Ireland!"

We make the acquaintance of the first of these "sprints" immediately on leaving Belfast. It is 25 miles from here to Portadown, where we make connection with the express from Londonderry. For this 25 miles the timetable allows no more than 30 minutes, despite the fact that for the first 16½ miles out of Belfast the line is largely on rising grades, as steep in parts as 1 in 148-248 for 2½ miles. Our driver will probably start gently out of Great Victoria Street, but by the time we pass Lisburn, 7½ miles out, where the line is fairly level, we shall be crossing the "sixty" line, and but little under 60 miles an hour will be maintained up to the miniature "summit" at mile-post 96. From here to Portadown we shall probably have no more than nine minutes left for the remaining 8½ miles, and it will be surprising if we do not exceed 70 miles an hour. On my last southbound journey with this express we touched 74 an hour through Lurgan, and comfortably gained a minute to Portadown, doing the 25 miles in 29 minutes.

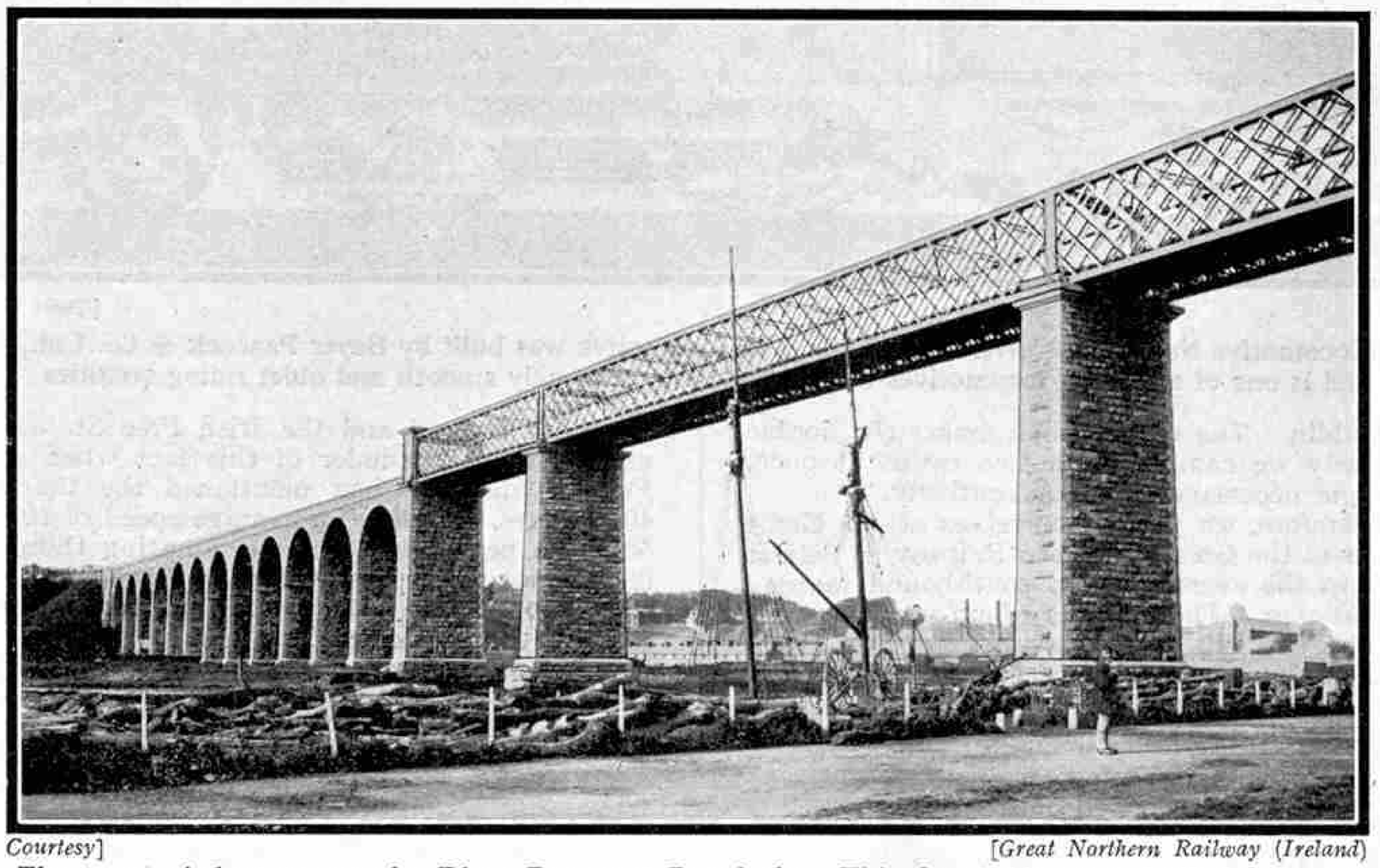
The next non-stop stretch is over the 33¼ miles between Portadown and Dundalk, during which we shall cross the frontier between Northern Ireland and the Irish Free State. We shall have the usual forcible reminder of this fact when we stop at Dundalk. For the distance just mentioned the timetable allows exactly 40 minutes, entailing an average speed of the merest shade under 50 miles per hour. But the amazing thing about this booking is that during its observance we have to climb right up through the mountains to Adavoyle Summit, which is 522 ft. above the sea! It is approached by arduous grades. Beginning at mile-post 74, we have two miles rising at 1 in 115-150 to Goraghwood, and then 6½ miles straight off mostly between 1 in 100 and 115, to mile-post 65½, which marks the actual summit. Not only so, but because of sharp reverse curves at Poyntzpass, between Portadown and Goraghwood, speed must be reduced, at a point where the train is making good speed over the tolerably level stretch of this section of the run.

Getting smartly away from Portadown at 6.5 p.m. we shall touch 60 miles per hour, probably, before the Scarva slack, and shall pass that station, eight miles, in about 11½ minutes. The slight dip before Portadown should produce a rather higher maximum, probably 65, and we shall then set out in earnest to climb. In the early stages of the ascent, fortunately, we say goodbye to the Warrenpoint coach, which is slipped at Goraghwood, the engine being thereby relieved of 30 tons or so. Goraghwood Junction, 15¾ miles, is passed in about 20 minutes, or slightly less. As we mount over the high viaduct at Bessbrook, the centre of whose 18 arches is 140 ft. above the valley, we shall be surprised to find the speed dropping but little, if at all, below 40 miles per hour. The climbing of the fine Great Northern superheated 4–4–0 engines up both ascents to this summit is, indeed, worthy of no small praise. Amid bare and mountainous scenery we breast the saddle between Clermont Carn and Slieve Gullion, and the driver notches up in preparation for the descent to Dundalk. The time up the 6½ miles from Goraghwood to mile-post 65½ has not been more than about nine minutes, and we may now prepare for thrills.

Much of the descent from Adavoyle to Dundalk is at between 1 in 100 and 125, or thereabouts, and the line is well laid out for high speed. For myself, I shall never forget my last trip down to Dublin on the footplate of this very express, when in the driving mist and impenetrable darkness of an October evening, with the engine rolling and surging as though she were a monster

alive, we most assuredly touched 80 miles an hour down past "Mount Pleasant"—the signal box and siding that breaks up the long section between Adavoyle and Dundalk. Although we may not repeat the "80" this evening, we may be pretty sure of something well up in the "70's," and probably 75 miles an hour, ere we draw up at Dundalk; and despite our magnificent climbing, it is unlikely that the tight schedule time of 40 minutes has been improved on. It is, in my judgment, the hardest locomotive proposition in Ireland, apart from the comparative lightness of the load behind the engine. Dundalk is reached at 6.45 p.m.

The lengthy wait at Dundalk is in curious contrast to the high speed that has just preceded it, but time has to be allowed for the Irish Free State customs officials to come and interview you, and it is to be hoped that they will find no dutiable articles concealed in your baggage, or the wait may be longer still! It is quite likely that the engine will be changed here also, a Dublin engine replacing the Belfast engine for the remainder of the journey.



Courtesy] [*Great Northern Railway (Ireland)*

The great viaduct across the River Boyne at Drogheda. This fine bridge was built by Barton in 1854-5. It has three main spans, a centre one of 265 ft. and two of 140 ft. each, at a height of 90 ft. above the river. The approach viaducts consist of 14 arches each of 160 ft. span

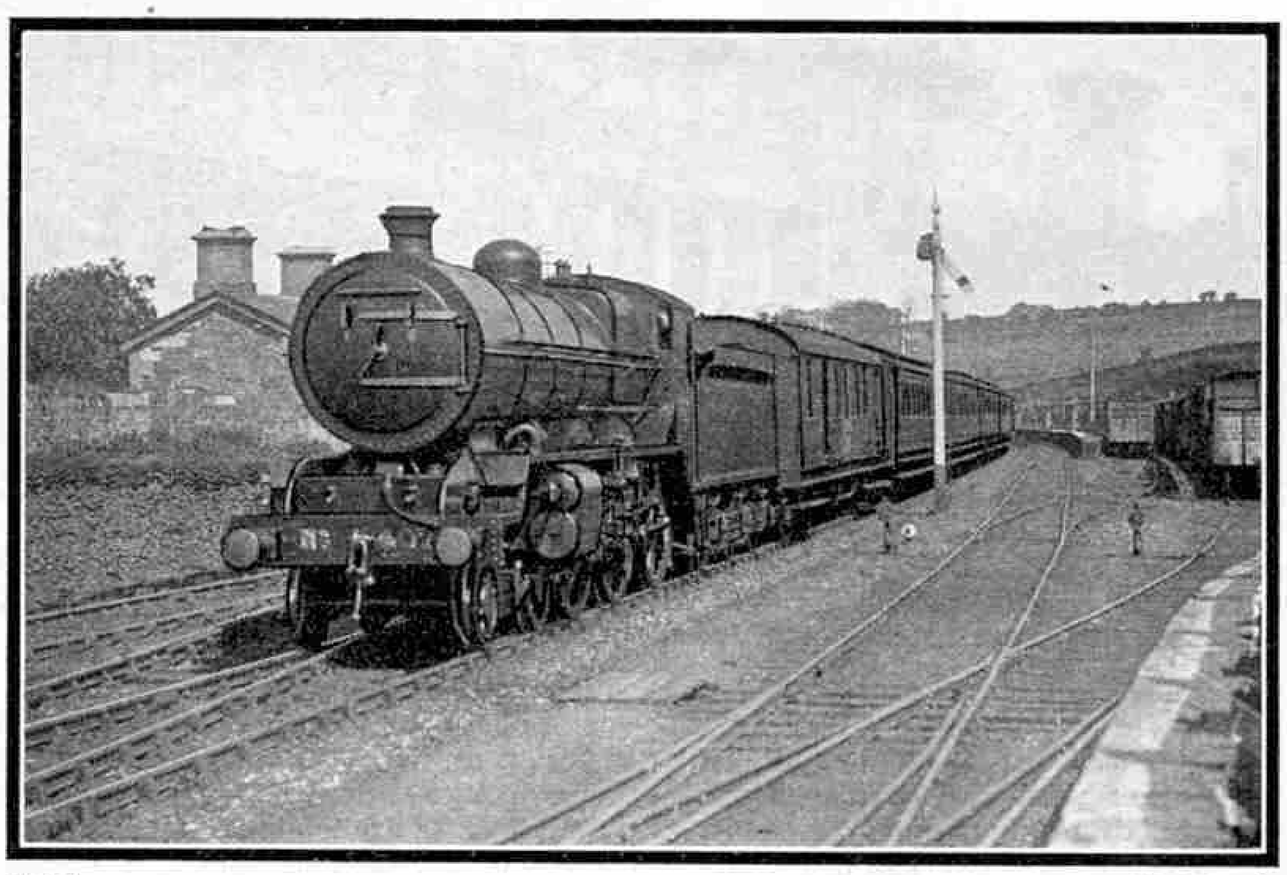
After no less than 13 minutes' standing, we leave Dundalk at 6.58 p.m. For the next 22½ miles to Drogheda, with their sharp undulations, the allowance is 27 minutes, the booked speed being therefore 50 miles per hour exactly. It should also be mentioned that we have attached at Dundalk a couple of corridor coaches through from Londonderry *via* Enniskillen and Clones, making up the total load to eight coaches, weighing about 265 tons.

We find the observance of the booking from Dundalk to Drogheda presents but little difficulty, however. There is a steep rise at 1 in 160 for 1½ miles out of Dundalk, followed by falling and then level grades to Castlebellingham, on which we get up to 65 miles an hour or so; then comes Dunleer bank, with its five miles up at 1 in 198, to the summit at mile-post 37½, followed by a corresponding descent to Drogheda. Just before stopping at Drogheda we run on to a high embankment, and then across the wide valley of the Boyne by the great Boyne Viaduct, with its three main spans, two of 140 ft. each and a centre one of 265 ft., and its approach viaducts consisting of fourteen 60 ft. arches. It is this viaduct which, as previously mentioned, is to some extent restricting locomotive development on the Great Northern, as it cannot carry more than certain maximum weights.

Drogheda we reach at 7.25 and leave at 7.28 p.m. For the final 31¾ miles of gentle ups-and-downs to Dublin the timetable concedes 37 minutes, but although this means an average rate of 51.5 miles per hour, it is perhaps the easiest booking of the four. Soon after leaving Drogheda we emerge on to the seacoast, at Laytown, and the rises and falls in the gradients after that mark the points where the line leaves the coast and then rejoins it. Most pronounced among them is the two-mile ascent, mostly at 1 in 150, to mile-post 16, which may bring our speed down to 50 m.p.h.; running down the other side of it we shall touch 68 to 70 miles an hour, very likely, as we pass Donabate. The 10 miles from Drogheda to Balbriggan should take 12½ minutes; then the 12¾ miles from there to Malahide 13 minutes; the 4¼ miles from Malahide to Howth Junction four minutes, and the last 4¾ miles into the stop at Amiens Street 6½ minutes, or so, which will bring us in just a minute ahead of time.

Our arrival is therefore at 8.5 p.m., 2 hrs. 35 min. after leaving Belfast, and as 21 minutes of this total has been spent in stops, the actual running time of 2 hrs. 14 min. for the 112½ miles represents an average travelling speed of just over 50 miles an hour for the whole distance—an excellent achievement, especially in view of some of the heavy grades surmounted *en route*. The through coaches for Dun Laoghaire are soon whisked off the rear of the train, but we must leave them and hasten to Cork in order to travel up with the Great Southern Company's "Limited Mail."

This express makes its exit from Cork at four o'clock in the afternoon. At one time the train started from Queenstown, or "Cobh" as it is now known, but the start is now made from the Glanmire Road Station at Cork, and a terrifically hard exit it is, too. Right from the start, up past Kilbarry to Rathpeacon, the line rises for 3½ miles at 1 in 70 and then 60—a nice proposition for an express engine making a "cold" start with a heavy train! Then there are 9 miles more of rising grades, 6½ of which are at between 1 in 150 and 1 in 285, ere the summit is breasted at mile-post 151½, 14 miles out of Cork. If our load is anything out of the ordinary, however, our powerful 4–6–0 locomotive may be certain of pilot assistance over the first 21¼ miles of the run, to Mallow, even though the timetable gives the liberal allowance of 34 minutes for the distance. It is difficult to lay down any precise load for the Cork "Limited Mail," as it varies a good deal according to the season, and according to whether any liners have been calling at Queenstown. We may expect, however, to have not less than seven or eight vestibuled coaches out of Cork, of much the same weight as those of the Great Northern line, and very probably more than this later on in the journey.



Photo] [*R. Murphy*

Down Dublin-Cork Mail hauled by four-cylinder 4–6–0 locomotive No. 407

It was the old Great Southern and Western Railway that introduced the first 4–6–0 engines to Ireland, as far back as 1905, but they were freight engines. Not until 1915 did the first 4–6–0 express engines, designed by Mr. E. A. Watson, make their ap-

pearance on Irish metals, and the same railway was responsible. These were four-cylinder locomotives, strongly reminiscent in external appearance of the Great Western "Stars," with the outside cylinders set well backward of the centre-line of the bogie, to drive the middle pair of coupled wheels; while the inside cylinders, advanced correspondingly forward, drove the leading pair. Subsequent experiments have given the Great Southern locomotive authorities a preference for two cylinders, however, and the latest 4–6–0 express engines have therefore two outside cylinders only. One of these fine modern engines we may expect to see at the head of our train. It is nothing unusual for the pilot from Cork to Mallow—the locomotive most readily available at the moment—to be a 0–6–0 freight engine, and the combination of dignity and impudence is then a quaint sight indeed!

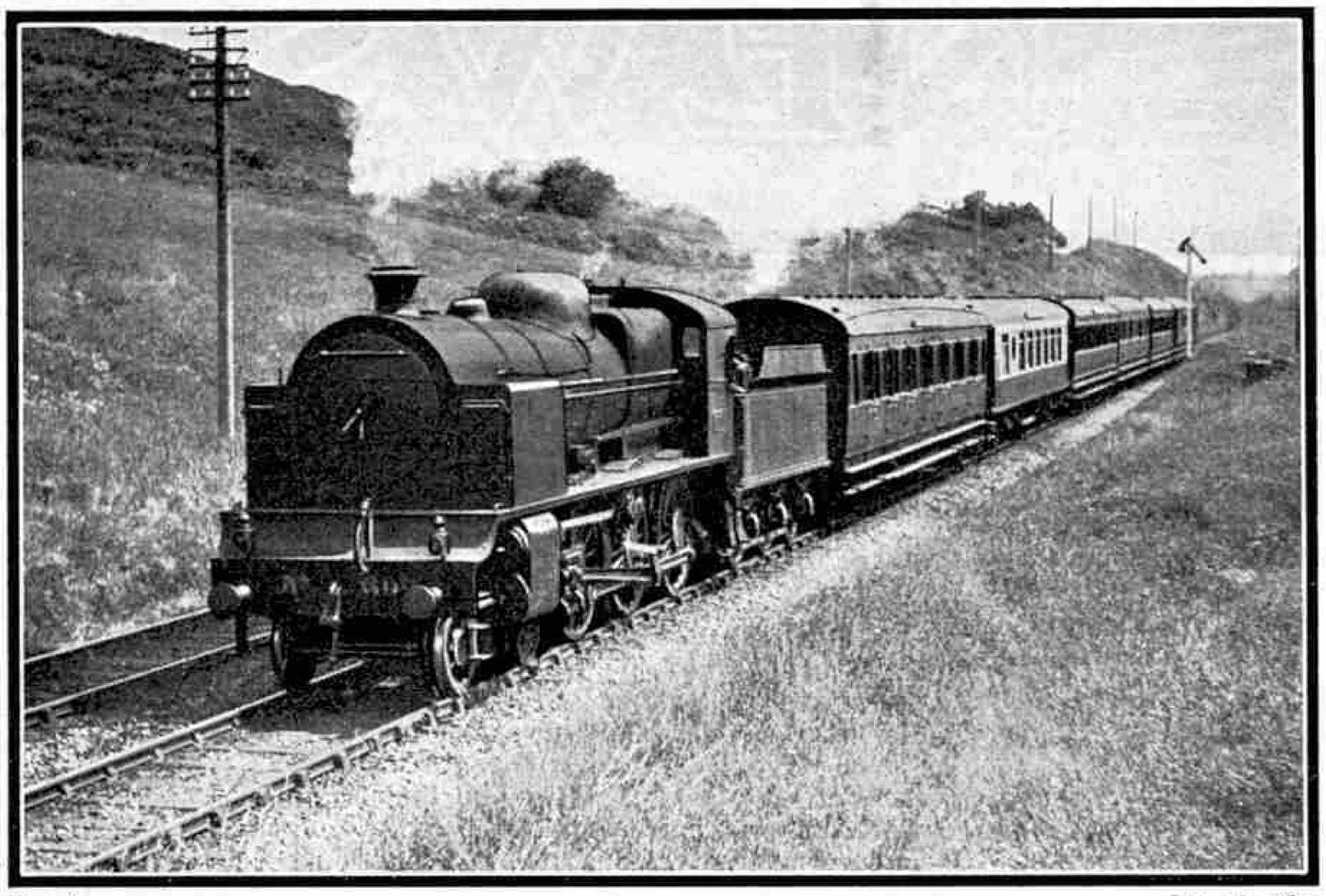


Photo [*R. Murphy*

The 12.30 p.m. Cork-Dublin express hauled by two-cylinder 4–6–0 locomotive No. 500, fitted with Weir feed pump and feed water heating apparatus

Just before running into Mallow we pass over a high viaduct spanning the valley of the River Blackwater. In the Irish troubles of some years ago the original Mallow Viaduct suffered heavily, as it was blown up. A complete breach was thus made in the Great Southern and Western main line, but this gap has now been bridged in a more substantial manner than before, steel replacing the previous masonry. Important connections come in at Mallow, from the Killarney line to the westward, and the Fermoy and Waterford direction to the east. Four minutes are allowed for this purpose and we get away at 4.38 p.m.

Out of Mallow our locomotive has another bad start, though far from being as formidable as that out of Cork. The rise in this case is for four miles at 1 in 151, to a siding rejoicing in the singular name of Twopothouse. To pass the summit at the 140 mile-post, 4½ miles from Mallow start, we may expect to take at least eight minutes, but after that the gradients are mostly with the engine for the next 16 miles, on past Buttevant and Charleville, over which we may expect to average 60 miles an hour or slightly over. From the 124 to the 112 mile-post the inclination is a little the other way, but 13 minutes should suffice, and a short and sharp descent brings us to Limerick Junction. This is a peculiar station, very similar in design to Cambridge of the L.N.E.R., having one long platform, looped off the main line, at which both up and down trains stop. Unlike Cambridge, however, the stopping trains run through past the platform, and then back into it, for which operation time has to be allowed in the schedule.

For the 37¼ miles from Mallow to Limerick Junction the booked time is 45 minutes, but we must make a start-to-stop run of 37½ miles in not more than 43 minutes, in order to allow two minutes for backing ¼-mile into the platform. This entails an average running speed over this sharply undulating road, of 52.3 m.p.h.

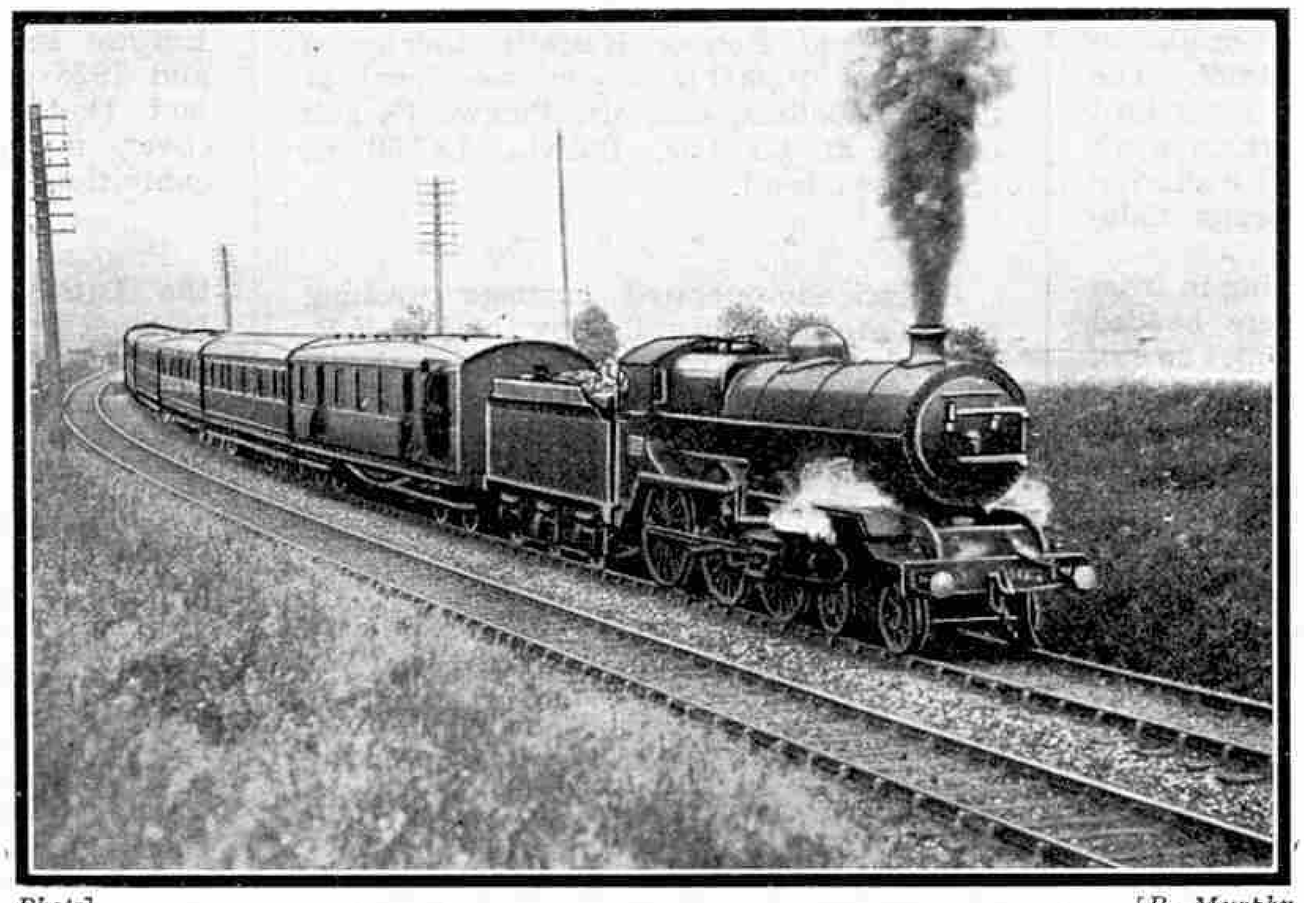


Photo [*R. Murphy*

Up English Mail with four-cylinder 4–6–0 locomotive No. 403

Just about here the Galtee Mountains are very prominent on the right-hand side of the train, about 10 miles away, dominated by the fine shape of Galtymore, 3,015 ft. in height.

We reach Limerick Junction, where, as its name implies, the connection comes in from Limerick as well as a connection from Tipperary, at 5.23, and get away at 5.28 p.m. Gentle ups-and-downs now lie ahead, nowhere steeper than 1 in 180 or 200 and of no great length, throughout the next stretch of 40½ miles to Ballybrophy. This is the fastest booking of the journey, only 45 minutes being allowed, which requires an average speed of 54 m.p.h. The chief purpose in stopping at Ballybrophy, which is almost exactly the midway point of the journey, is that our engine may take water, the Irish lines being unprovided with water-troughs. Ballybrophy is reached at 6.13 and left at 6.17 p.m. The next run, to Maryborough, is short. The 15¾ miles are allowed 20 minutes, and as, 1½ miles out of the Ballybrophy start, we strike three miles of downhill at 1 in 128, and there are other favourable grades, the booking very likely proves quite a minute more than we require. The Slieve Bloom Mountains, away on the left-hand side of the train, relieve what is otherwise some very flat country hereabouts.

Dublin is now the next stop ahead. We are 51 miles distant and, reaching Maryborough at 6.37 and leaving at 6.42, we have 58 minutes left in which to complete the distance, at an average speed of 52.7 m.p.h. From Maryborough we have an excellent downhill start of 1½ miles at 1 in 170, and, indeed, grades generally falling for some 11½ miles in all. We swing through Portarlington, 9¼ miles, in 11 or 12 minutes, and hurry up the four miles at 1 in 180 past Cherryville Junction into Kildare, without the speed falling much below 50 m.p.h. Kildare, 20¾ miles, is passed in 24 minutes at most. The flat plain of the Curragh, so extensively used for military purposes, appears on the right, backed up in the distance by the mountains of Wicklow, to which we draw gradually nearer as we approach Dublin.

All the difficulties of the journey are over, and for the final 27½ miles nothing but falling grades lie ahead. This final schedule, indeed, proves a useful "recovery" margin for time lost earlier in the journey. So we pass Newbridge, Sallins, Straffan, Lucan and Clondalkin; the descent steepens past Clondalkin, the final four miles—a hard start for southbound trains—being at 1 in 169, then 138, then 104 and last of all 81 as we pass Inchicore. The birthplace of our locomotive is seen at the Inchicore Works, on the right of the train, and then we drop into Kingsbridge. The time is 7.40 p.m., and we have made our journey of 165½ miles, with four stops totalling 19 minutes, in 220 minutes—an excellent piece of locomotive work. Erin need fear little in the comparison of her express running with that of Great Britain.

Holiday Traffic at Carlisle

A visit to Carlisle at the height of the holiday season proved of unusual interest. A special corridor excursion from Manchester was hauled by 2–6–0 No. 13021, being banked up Shap incline by a new standard 0–6–0 Tank. The train load was 415 tons and good time was kept, a speed of 70 m.p.h. being attained on the favourable stretch from Shap Summit into Carlisle.

During a few hours spent at the Citadel Station, some particularly interesting locomotive exchanges and workings were observed. The "Thames-Clyde Express" came in off the Midland system with "*Sir Gilbert Claughton,*" and the Edinburgh portion was taken on by N.B. 4–4–2 "*Tweedale.*" A south-bound train of loaded fish vans was taken by Caprotti-fitted "Claughton" (with large boiler) "*Sir Francis Dent.*" A north-bound Liverpool and Manchester express to Glasgow was brought in to time by unrebuilt Claughton No. 5954, piloted by old Precedent No. 5034, "*Glow-worm.*" It is curious to find these veterans still piloting West Coast expresses, despite their origin in 1869 and only rebuilding in 1892. The train mentioned was taken on by a standard compound, large numbers of which work into Carlisle to the almost total exclusion of passenger engines of the former Caledonian and G. & S.W. Rlys.

Most of the heavy trains coming in from the North Western system were headed by L. & Y. type 4–6–0's, sometimes two of these massive engines being changed at the Citadel Station for a single compound 4–4–0. A few "Royal Scot" class were also on view, including the original 6100, "*Royal Scot,*" which has an extremely ugly smoke deflecting apparatus enveloping its funnel, the effect being reminiscent of old-time Belgian engines with their hideous square stacks.

The up "Mid-day Scot," with 14 carriages on, was brought in by a Caledonian "Mackintosh" 4–4–0, piloted by a standard compound, and left to time with a very formidable combination, 6032 "*Phœnix*" train engine, and four-cylinder 4–6–0, 10461, pilot.

Trains from Whitehaven and Barrow were worked by Furness Section 4–4–0's and Crewe engines, including the old rebuilt Webb compound "*Canopus,*" still carrying her North Western number plate "1913." On the L.N.E.R. section, expresses from the Waverley Route were drawn by North British Atlantics, "*Buccleuch,*" "*Holyrood,*" "*Waverley,*" "*St. Johnstoun*" and "Scott" class "*Redgauntlet.*" New three-cylinder Darlington-built 4–4–0's "*Berwickshire*" and "*Peebles-shire*" were also working these expresses, while North Eastern trains from Newcastle were largely in the care of Class R. 4–4–0's.

The Langholm branch train consisted of two carriages drawn by a North British 0–4–4 Tank, while the historic Port Carlisle branch was operated by new Sentinel steam coach "*Nettle.*" A local workmen's train of four dilapidated four-wheeled carriages was honoured by being propelled by a Caledonian 2–6–0 of the inside-cylinder variety.

The station pilots at Citadel Station on the day of these observations were Precursor "*Cyclops,*" and a Glasgow and South Western 0–6–2 Tank. The former engine's duties were taken over in the evening by Midland 4–4–0 No. 483, painted in the new black livery.

* * * *

The Highest Railway Officer in the World !

Mr. Wm. Pickwold, the manager of the Antofagasta and Bolivia Railroad, has the distinction of being the highest railway officer in the world, and also president of the world's highest golf club. The Antofagasta and Bolivia Railway touches a height of 16,000 ft. above sea level at Condor, Bolivia, and Mr. Pickwold's golf club is at La Paz, Bolivia, 13,500 ft. above sea level.

* * * *

Electrically-operated carriage washing plants are being installed by the L.N.E.R. at their Ilford, Cowlairs and York sheds. These installations consist of a series of vertical drums with brushes so fitted on both sides of the track that they rotate at high speeds and thoroughly wash and spray complete trains as they are shunted through.

* * * *

A Curious Railway Coincidence

A curious railway coincidence that existed some 10 years ago is recalled by the opening of a through railway route to Pensacola by the St. Louis—San Francisco Railroad. The route uses the rebuilt line of a railway known as the Muscle Shoals, Birmingham and Pensacola Railroad, which 10 years ago was known as the Gulf, Florida and Alabama line. Not far away was another G.F. and A. line, the initials in this case standing for Georgia, Florida and Alabama. Each of these lines with the same initials was 150 miles in length and ran from the Gulf to points in the interior, but the most extraordinary feature of all was that the interior termini of both were at towns bearing the same name—the Gulf line ending at Kimbrough, Alabama, and the Georgia line at Kimbrough, Georgia !

The Morris Track Layer

The London & North Eastern Railway, in their continual search for economical methods of working, have decided to experiment with the Morris track layer. This is a machine that takes up and relays track in complete sections, and affords a considerable saving over the customary labour methods adopted for relaying by British railway companies, which involve handling manually, several times over, more than 500 tons of materials for every mile of track laid.

The Great Southern Railway of Ireland have been experimenting with such a machine for 3½ years, and have secured every satisfaction ; in fact, their labour costs for track relaying have been reduced by nearly 40 per cent.

* * * *

It is stated that the L.M.S. Railway are the largest owners of warehouses and storage yards in the United Kingdom. Actually they control warehouse flooring totalling ten million square feet. It is difficult to realise the vastness of this area but readers who visited the British Empire Exhibition at Wembley in 1924 and 1925 may form some idea from the fact that the L.M.S. warehouse space covers many more acres than that huge exhibition.

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Proposals recently were placed before the Turkish Government by an Anglo-Italian group of financiers for the construction of a railway line linking Rome with Salonika, Dedeagatch and Constantinople.

* * * *

Fletton Brick Traffic

An excellent idea of the extent of the brick industry at Fletton, near Peterborough, is conveyed by a recent L.N.E.R. announcement that all records for Fletton brick traffic were broken during June of this year, when 10,219 wagons of bricks were loaded. This was an increase of 262 wagons over the corresponding month last year. Actually in 1927 the L.N.E.R. carried 1,061,671 tons of bricks from Fletton, this being 32,553 tons more than in 1926.

* * * *

South African Order for Britain

The biggest order received by the Tees-side iron and steel industry for many years was recently placed by the South African Railways Administration with Messrs. Dorman Long & Co., for 47,000 tons of steel rails. The last South African order for rails was given to Germany, but in service these were found to be considerably less satisfactory than an earlier British supply.

Trials of a Taff Vale Railwayman 50 Years Ago

A lecturer at the Institute of Transport recently gave a description of the astounding working conditions existing on the old Taff Vale Railway half a century ago. In the "70's" a Taff Vale railwayman was liable to be discharged if he whistled, joked, or wore red clothes, and his only hope of earthly promotion lay in making a display of interest in the hereafter! Every worker was required by rule 12 to come to duty properly dressed, shaved and with shoes blacked and, in addition, he was required to keep his hair neatly cut. Even after he had made his appearance in correct style he was still liable to trouble for rule 40 explicitly stated that any instance of intoxication, whistling or levity on duty would not be overlooked. An offender in this direction was not only dismissed the service but was liable to further punishment. Rule 66 actually laid down a table of fines for talking, shouting, hooting or making any unpleasant noise or unseemly action whether by hand, mouth or otherwise. Sunday observance was supposed to be a matter of personal preference but rule 26 gave the show away completely for it read: "It is urgently requested that every person, on Sundays and Holy Days, when he is not required on duty, will attend a place of worship, *as it will be the means of promotion when vacancies occur*"! (The italics are ours).

There were no smoking compartments on the Taff Vale Railway in those days and, in fact, for an employee to smoke anywhere within the range of a railway official's nose was equivalent to industrial suicide. Rule 50 laid down that "smoking by any passenger or by any person, where in the employ of the Company or not, upon any part of the Company's premises or any carriage or train is strictly forbidden, whether such person is travelling or otherwise."

They were spared one modern evil in those days, however, for strap-hanging was forbidden, rule 54 making it obligatory to sit down or get out! The rule read: "The company's officers and servants are not to allow any person to stand in any of the carriages or wagons but compel them to sit upon the seats or floors; should they refuse to comply they must be removed and given into the charge of the Company's police." It is a little difficult to imagine staid middle-aged business men travelling home from their daily toil in the city comfortably ensconced upon the floor of a tube train!

The directors evidently believed in "safety first," for no railway servant or employee of a railway contractor was allowed to use wearing apparel of red or pink colour because it might be the means of causing enginemen and others to think it was a signal of danger!

LOCOMOTIVE 'BLINKERS'!

Our photograph shows the S.R. 'King Arthur' Class locomotive No. 787, "Sir Menadeuke," leaving Southampton West Station. This engine is of particular interest as it is fitted with smoke deflectors. Owing to the comparatively light beat of the exhaust, when engines of this kind are worked at an early cut-off, the smoke does not leave the chimney with sufficient force to clear the cab, but hangs over the boiler, thus obstructing the driver's outlook. The deflectors are fitted to create an upward current of air, which carries with it the smoke.

L.M.S. Private "Diners"

Two new types of corridor coach have been introduced on the "*Royal Scot.*" One is fitted up as a lounge with easy chairs and small tables at which light refreshments can be served. The other is a dining car, half of which is divided into compartments, each decorated in a different style, for the accommodation of small private parties travelling together.

* * * *

For repairs, renewals and new track, the Canadian National Railways will require no less than 9,000,000 sleepers during the coming year.

* * * *

Compulsory Insurance for Travellers

The Spanish Government have issued an order compelling every passenger who uses Spanish railways to take out an accident policy. The premiums range from approximately ¾d. to 2½d. according to the class of accommodation and in the event of an accident the company will pay by way of compensation sums ranging from £375 to £1,500.

It is interesting to note that since this order was issued the Spanish Government have issued a further order making insurance compulsory for all air travellers in Spain. In this case a premium of 15/– will cover a policy for £4,000.

L.N.E.R. Rail Coaches

The following named Clayton steam rail coaches, to which reference was made in our issue for May last, are now working in the Newcastle area:—"*Rapid*," "*Royal Sailor*," "*Wellington*," "*Wonder*," "*Union*," and "*Comet*." Each of these is shedded at Heaton, which also houses the Sentinel rail coach "*Integrity*." "*Chevy Chase*," another Clayton coach, is working on the Grantham, Lincoln and Market Rasen section. Sentinel coaches "*Hero*," "*Liberty*," "*Neptune*," and "*North Star*" are working from Shildon shed in the Bishop Auckland area. "*True Briton*" is located at Starbeck and is operated between Harrogate and Knaresborough.

* *

A Polar Railway

One of the oddest railways in the world is in Russia. It was built during the War to open up a port on the Arctic Ocean, and its northern terminus is at Murmansk, 147 miles north of the Arctic Circle. From Murmansk it extends southward to Petrozabodsk, 652 miles. This railway claims to be the only railway in the world operating a dining car service north of the Arctic Circle!

* * * *

L.M.S. Locomotive Livery

Many readers have written to us asking for an explanation of the apparent lack of uniformity of the livery of L.M.S. locomotives. It seems that the deletion of numbers from the tenders and the placing of numbers on the engines is being carried out by local depots as a temporary expedient until the stock goes for its periodical repaint. Inevitably, in such circumstances, the style and size of the lettering must vary.

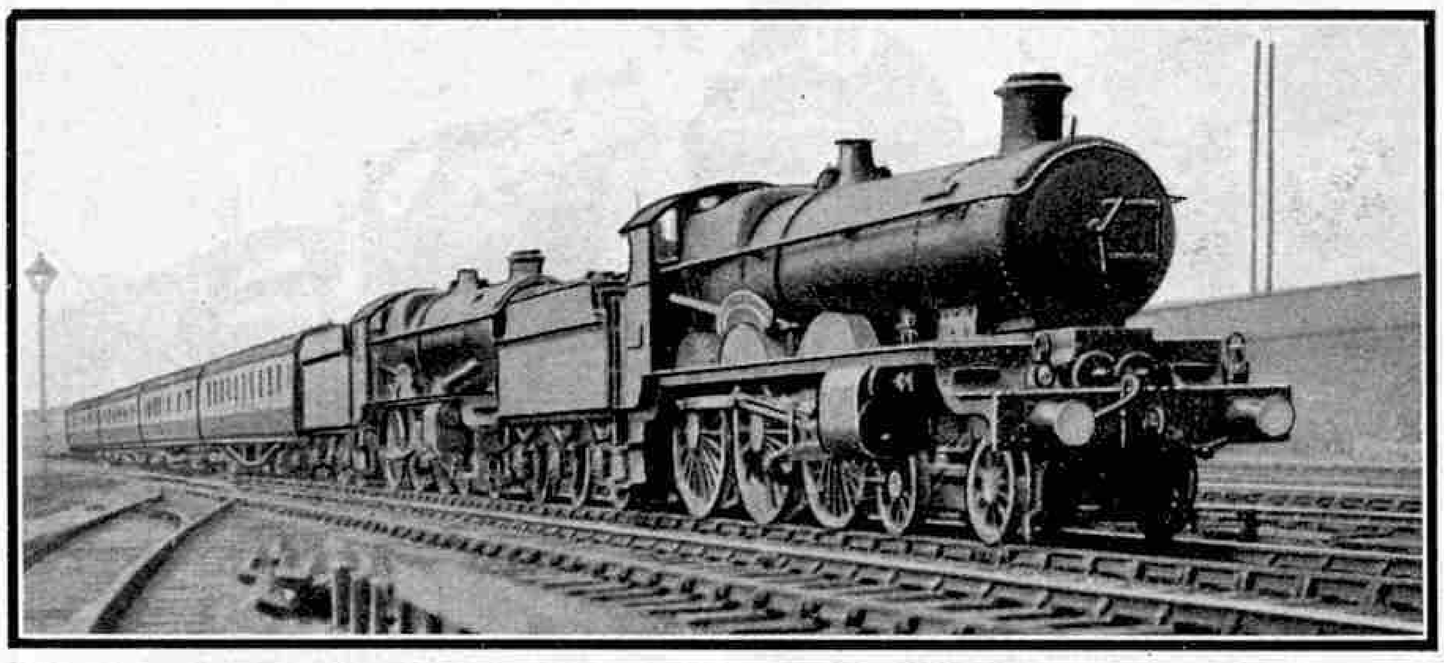
It was the practice of the old L. & N.W.R. to number their tenders independently of the engines, and it seems probable that the L.M.S. are reverting to that practice, for it is no longer possible to rely upon the number of the engine being the same as that on the tender. One cannot help contrasting the present confusion, resulting often in a liveried engine hauling a black tender, and black-painted engines hauling red tenders and liveried rolling stock, with the old characteristic of the Midland Railway, where passenger train locomotives, tenders and carriages all were painted to match. The stern necessity for economy is the sole reason for the abolition of livery to so marked a degree.

Collecting Railway Photographs:

A Worth-While Hobby

By Arthur Phillips

ALMOST all boys, sooner or later, are caught in the craze for collecting things. Tram-tickets, cigarette cards, postage stamps—these and other things become the objects of their ardent pursuit. Stamp collecting is, indeed, a splendid hobby and now occupies the attention not only of schoolboys, but of many adults and even scientific men. But the collecting of tram-tickets and cigarette cards does not lead us very far—there comes a time when our enthusiasm for them wanes, and we feel that we want to collect something more advanced and something that is of more lasting value. I am writing this article to suggest that this want may be admirably met by the collecting of photographs of locomotives and trains and other railway subjects. And I do this with the greater confidence because undoubtedly the most popular of all cigarette cards that have been issued have been the series of locomotive and railway pictures.

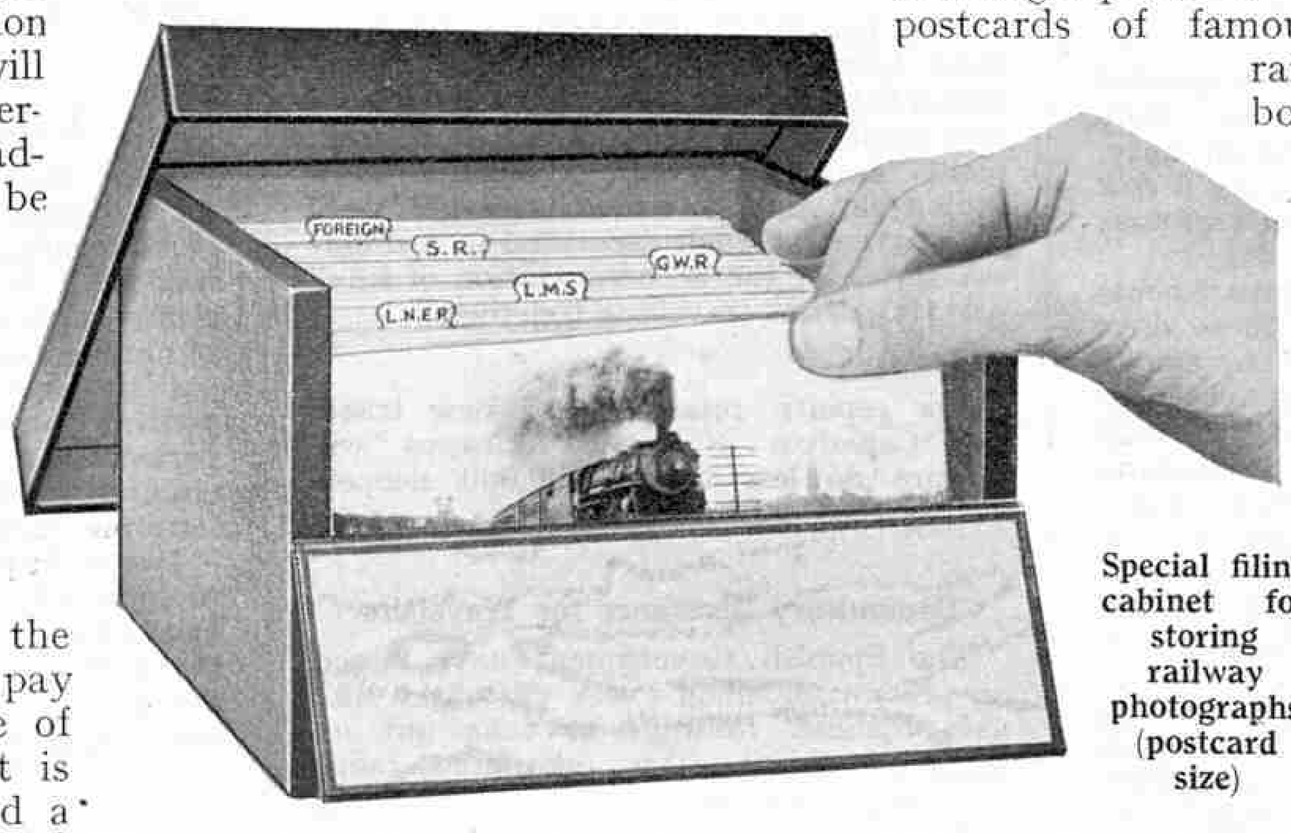


This fine photograph, taken for Railway Photographs, Liverpool, last month, shows the up Plymouth Express hauled by the "*Princess Louise*" and "*King George V*"

To anyone who is at all keen on railways—and surely almost all boys are very keen—the making of a collection of railway photographs will provide an unending interest. It has the decided advantage that it need not be an expensive hobby. The collecting of postage stamps sooner or later calls for the expenditure of a considerable amount of money. The common stamps, with which the collector begins, are cheap enough, but later when he seeks to obtain the rarer ones he will have to pay big prices. In the case of photographs, however, it is never necessary to spend a great deal of money on them. Of course, for enlargements, prices do run into fairly big figures, but the collection of large prints is by no means necessary or desirable.

In my own collection I have pictures of all sizes, ranging from vest-pocket snaps to some truly magnificent photographs measuring 40 in. × 24 in. Although these latter are very useful as illustrations when I give talks to boys and others about engines and trains, they are really too big and unwieldy for private purposes. I have a considerable number of pictures 15 in. × 12 in.—mostly official photographs—and I value these highly, but the size I chiefly favour is the postcard, for postcards are easily carried, handled and stored. Best of all, the supply of railway postcards is plentiful and the prices reasonable. Therefore, whilst pictures of many sizes may be included in a collection, I suggest that the handy postcard should be made the standard unit.

There are many sources of supply for these postcards. To begin with, the railway companies publish some photographs showing different locomotives and trains. There is, for instance, the artistic coloured card, issued by the L.M.S., of the new giant engine "*Royal Scot.*" The Great Western Railway has published some photographs of the world-famous "*King George V,*" and the Southern Railway offers quite a large selection of cards. The L.N.E.R. has issued postcards of the "*Flying Scotsman*" and also larger prints of it. In many shops picture postcards of famous expresses and other railway subjects may be bought.



Special filing cabinet for storing railway photographs (postcard size)

Some of the best postcards that have come to my notice, however, are those issued by Railway Photographs of 23, Hanover Street, Liverpool. This firm now holds the negatives made by Mr. F. E. Mackay, whose name is famous as a railway photographer and whose splendid photographs have regularly appeared in the pages of the "*M.M.*" I warmly welcome this new firm of railway photograph publishers and can confidently recommend their goods. Whilst their prices are exceptionally low, the quality of their work is exceptionally high.

Apart from such regular sources of purchase, anyone who sets out to make a collection will find that pictures come to him in many ways. For instance, some of my friends correspond with friends overseas and in foreign

countries, and exchange cards with them. It is not difficult to find a friend overseas who is interested in railway matters, and the Meccano Guild Secretary is always able to help in this direction if desired.

The exchange of postcards with friends abroad helps to widen our views and gives us something definite and interesting to write about. There are many boys and men abroad who collect these railway photographs, and they are naturally desirous of exchanging cards of their own country with those showing British engines and trains. The exchange of photographs also means the exchange of ideas between collectors, and in this way much interesting information may be gathered and valuable additions to the collection of railway photographs made.

If the collector is a photographer himself he will be able to make many of his own pictures, and I am reminded that an article on this subject, by Mr. F. E. Mackay, appeared in the September 1927 issue of the "*Meccano Magazine.*"

From all these sources, then, many a photograph may be obtained, and by keeping a constant look out for new types and additions as opportunity occurs, anyone who cares to do so can in time acquire a large representative collection.

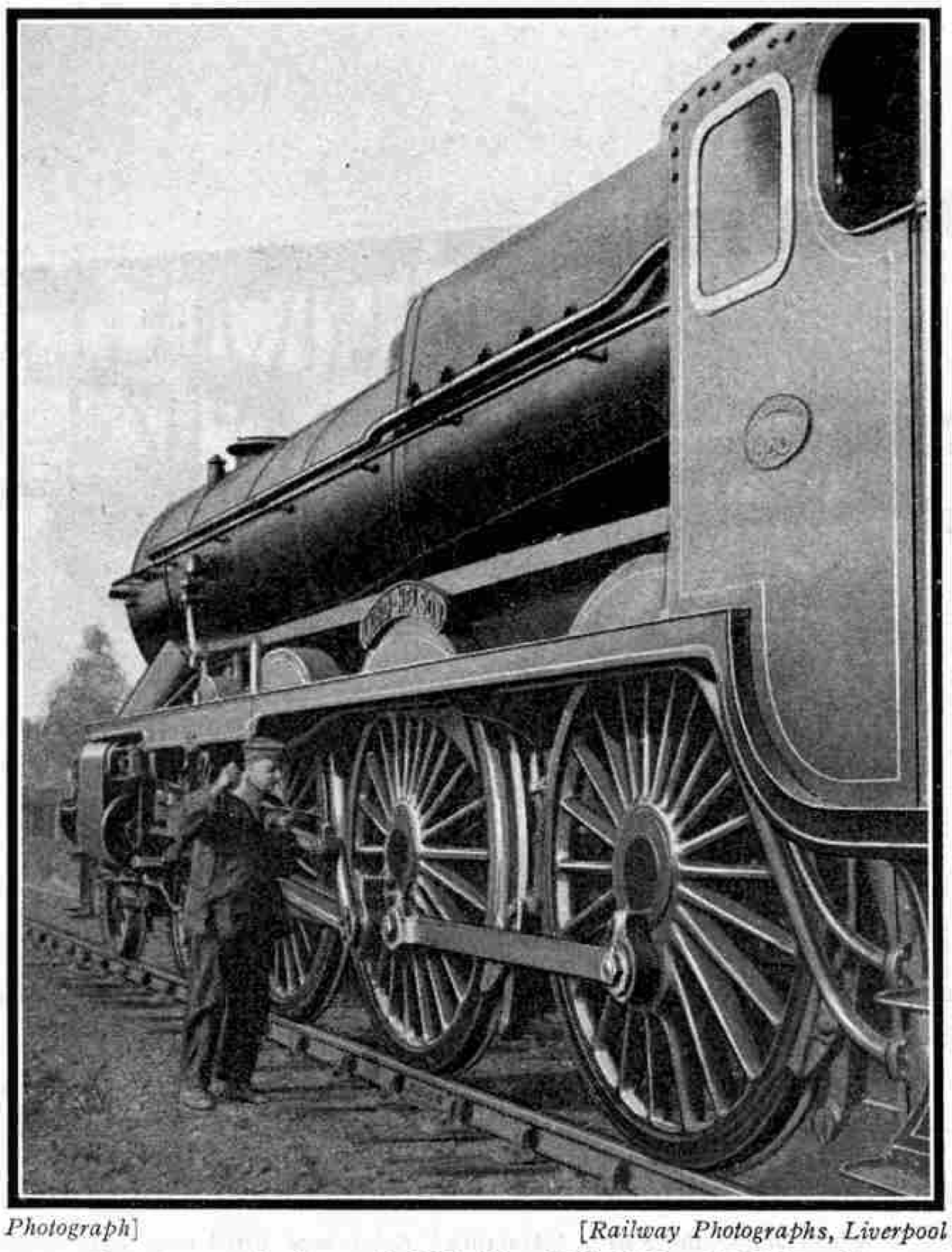
Perhaps a word should be added as to the methods of keeping such a collection of railway photographs. Appropriate grouping and an orderly sequence should be aimed at, for a collection that is kept haphazard and without order loses much of its interest and value.

For the smaller sizes—and for postcards in particular—albums are very convenient and enable the items in the collection to be readily passed in review. I confess, however, that I keep a considerable portion of my own collection in envelopes, and I find that in that way they are best preserved clean and undamaged and are less likely to fade.

When the collection grows to larger proportions, more elaborate methods of filing are desirable. Boxes to hold postcard size collections, together with sets of guide cards, are listed from 2/6 by the firm above mentioned (Railway Photographs). These specially-designed boxes form an admirable means of storing photographs, being both convenient, compact, and dust-proof. As the collection grows the cards may be transferred to the larger boxes, or to the special two or four-drawer cabinets listed by the same firm. These boxes and drawer-cabinets are by far the most economical and neatest means of storing the collection.

Each collector will follow his own ideas and preferences in the order of grouping and arranging. For myself, I keep the older types together, according to the particular period in locomotive history to which they belong. In other cases, I group a series as all belonging to the same railway. But with the differently-coloured guide cards supplied, it is possible to arrange the collection on almost any system. It is here that the orderly habits and organizing powers of the individual collector find a means of expressing themselves.

The exact character of the collection will be determined largely by the special interest of each collector. Whereas one will concentrate on a particular railway and get every possible picture representative of it, another will be universal in his tastes and will include foreign and colonial, as well as British railways. Then there is the specialist—as, for instance, one friend of mine who makes it his particular aim to get all possible photographs of railway accidents!



Photograph] [*Railway Photographs, Liverpool*

An unusual view of S.R. No. 850 "*Lord Nelson*"

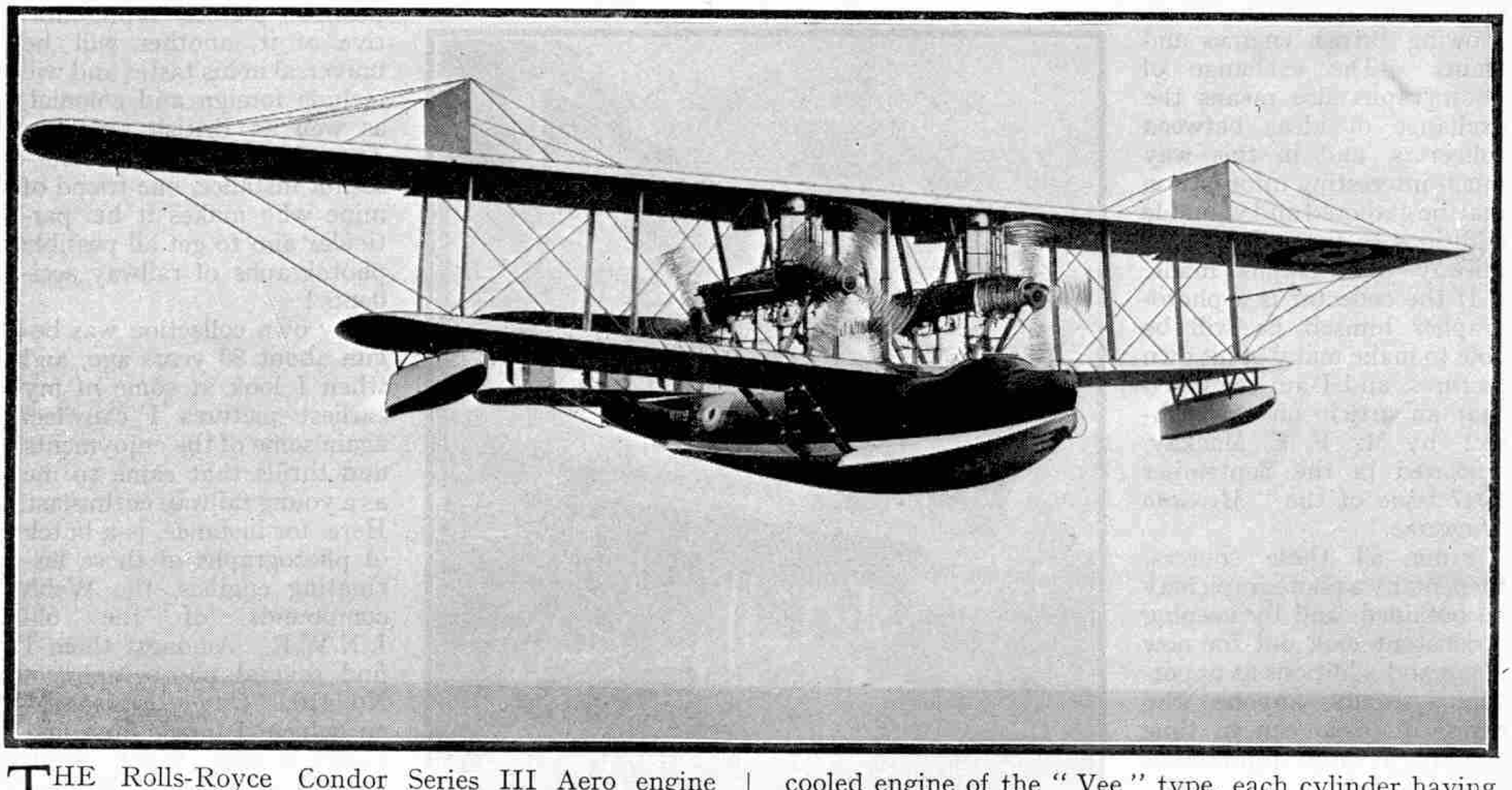
My own collection was begun about 30 years ago, and when I look at some of my earliest pictures I can feel again some of the enjoyments and thrills that came to me as a young railway enthusiast. Here, for instance, is a batch of photographs of those fascinating engines, the Webb compounds of the old L.N.W.R. Amongst them I find several photographs of No. 410, "*City of Liverpool,*" on which I made my first footplate trip. What an adventure that was! The engines of that class were nick-named "Jumpers" and they well merited the name! At speed they had a queer motion, jumping up and down and swaying from side to side. As I look at the picture before me, I can feel that peculiar motion and vividly recall that exhilarating ride. Another picture in the group is of No. 1306, "*Ionic,*" which on 8th September, 1895, made the first non-stop run from Euston to Carlisle—a run that has now become a regular occurrence.

Turning over other old L.N.W.R. pictures, I come across one of No. 790, "*Hardwicke,*" a 2–4–0 simple engine of the "Precedent" class, which made the record run during the great railway race of 1895, travelling from Crewe to Carlisle at an average speed of 67.2 miles per hour. The next picture I find is of No. 955, "*Charles Dickens,*" another famous "Precedent," that used to regularly run between Manchester and London and covered more than two million miles before finishing service!

With a pang of regret, I reflect that many of these old favourites have now gone to the scrap-heap, but all the more do I value the pictures that help to keep their memory green. Those who start a collection of railway photographs now will be able to similarly look back in years to come on some of their early-acquired treasures. Imagine, for instance, looking at a print of the "*Lord Nelson*" or "*King George V*" in 50 years' time! Possibly these fine locomotives will then be as antiquated-looking as "*Locomotion No. 1*" and "*Rocket*" seem to us to-day.

Famous Aero Engines

III.—The Rolls-Royce "Condor III"



THE Rolls-Royce Condor Series III Aero engine was originally designed towards the end of the war, principally to meet the need for an engine with the quality and reliability of, but a higher power than, the Rolls-Royce "Falcon" and "Eagle" types. This originated in the Condor Series I, an engine designed to develop 550/600 h.p. instead of the 370 h.p. of the "Eagle" engines, while being almost a duplicate of its smaller brothers. In fact the only noticeable difference, except in size, was the fact that it had four valves per cylinder where only two had been used in the smaller engines.

Of this type only a few engines were built, however, and shortly it was succeeded by the series IA, a type which, after being extremely successful in many different kinds of aeroplanes, was again superseded by the present Series III, an engine still practically the same as the "Eagle" in general design but some 300 lb. lighter in weight than the earlier type, and developing a normal 650 b.h.p. at 1900 revs. per minute.

The above photograph shows the Fairey "Atalanta" flying boat fitted with four Rolls-Royce Condor engines totalling 2,800 h.p. This and its sister ship the "Titania" were in the service of the R.A.F. and were the largest flying boats in the world. They were capable of weathering all but the fiercest gales while at anchor and of cruising for days on end without returning to their base, sleeping accommodation being provided for the crew of six. These boats are no longer in active service.

Specification of 650 h.p. "Condor III"

Water-cooled, 12-cylinder "Vee" type	
No. of Cylinders	12
Bore	5½ in.
Stroke	7½ "
Normal Crankshaft Speed	1,900 r.p.m.
Normal B.H.P.	650
Normal Propeller Speed with .477 Reduction Gear	907 "
Fuel Consumption	45 gals. per hr.
Weight of Engine, including carburetters, magnetos, distributor and pipes for power starter, exhaust boxes and reduction gear	1,336 lbs.

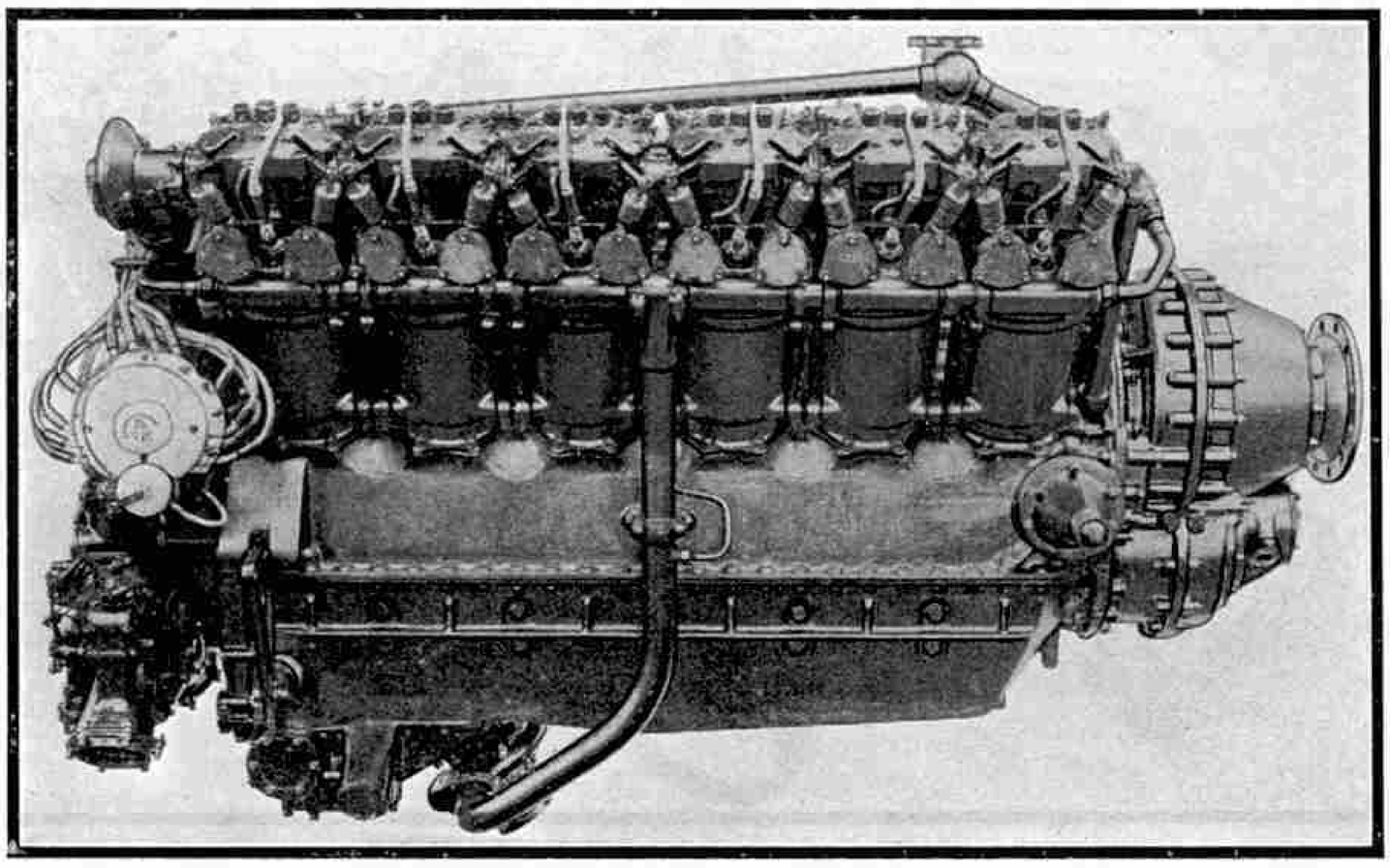
The "Condor" Series III is a twelve cylinder water cooled engine of the "Vee" type, each cylinder having a bore and stroke of 5½ in. and 7½ in. respectively. The cylinders are separately mounted on the crankcase in two rows of six, at an angle of 60° with each other. Each cylinder is of all-steel built-up construction and is machined from 6 per cent. carbon steel forgings, while the water jackets are of die-pressed steel, acetylene welded at the joints.

Two inlet and exhaust valves operated by overhead camshafts and rockers are provided for each cylinder. These seat direct in the almost spherical cylinder heads, with the result that their stems are consequently divergent owing to the angle at which the cylinders operate. The valves are made of special high chromium steel forgings and work in guides of phosphor bronze.

The camshafts are machined from case hardened nickel steel bar, while the valve rockers are nickel steel forgings. Each camshaft is provided with six aluminium bearings, four of which are in halves and bolted together, while the end bearings are of the one-piece type. They are driven by means of inclined tubular driving shafts,

with bevel gear at both upper and lower ends, all the gears being totally enclosed in a casing. All the shafts run on ball bearings.

To operate the divergent valves, tappets are interposed between the cams and each rocker, the latter being arranged to swing in a plane coincident with or parallel to a plane in which its valve lies.

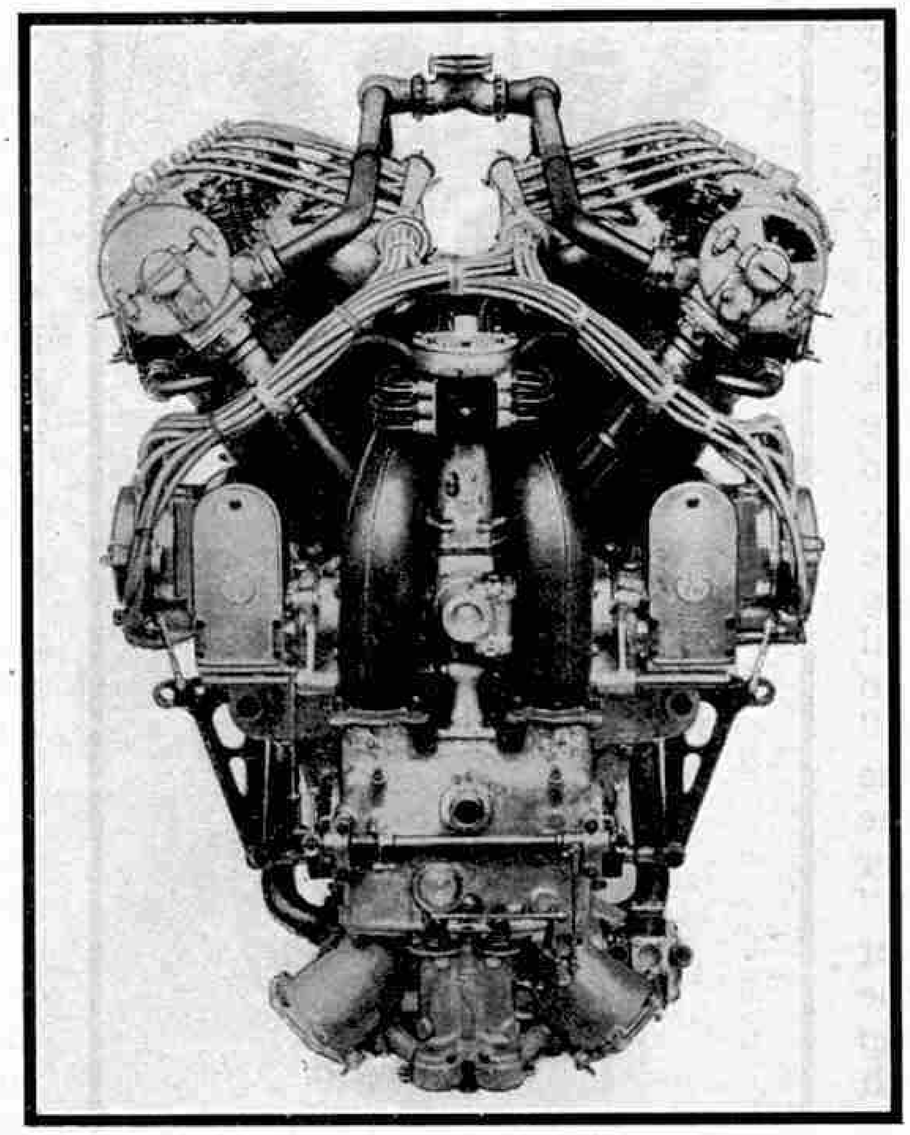


The Rolls-Royce Condor III aero engine of 650 h.p.

The gears are made from case-hardened nickel steel very accurately fitted to shafts running in ball bearings. The "Zephyr" type of piston is used, made of special aluminium alloy. The advantages of this type of piston are that the crown or head is better supported and the cooling of the piston head is considerably improved. Four piston rings are fitted to each piston, three being arranged as compression rings above the gudgeon pin and the other as a scraper ring below the pin at the base of the skirt. Both axial and rotational movement of the piston on its gudgeon pin is prevented by means of a special locking device.

The connecting rods are of nickel steel "H" section metal and are specially machined all over to ensure each rod being of uniform weight.

A divided white metal lined steel block is bolted to the forked rod; the other rod works upon the centre portion of the steel block, the latter having white metal bearing surface. The small ends of both rods are fitted with "floating" phosphor bronze bushes. All bearings are positively lubricated under pressure. The six-throw crankshaft is machined from a nickel chrome steel forging, all the journals and crankpins being bored for lightness and to convey lubricating oil to all bearings and connecting rods. The crankpins and journals are accurately ground to close limits for size and trueness of diameter. The crankshaft is carried in seven bearings of ample proportions.



The Condor III engine seen from the carburetter end

The crankcase is of special aluminium alloy, and is made in two halves of box section suitably ribbed to give the necessary stiffness. The main bearings, consisting of divided mild steel shells, white metal lined, are held in the upper half crankcase by special duralumin caps, which are secured by long bolts adjacent to each bearing. Facings are formed on each side of the caps that fit between corresponding facings formed on cheeks within the lower half crankcase. Horizontal bolts pass through the lower half crankcase and the caps, holding these parts rigidly together. This arrangement secures the rigidity of one in which the caps are integral with the lower half, while retaining the advantages of caps bolted only to the upper half.

A shaft driven from the timing gear is arranged to drive three oil pumps — two "scavenger" and one "pressure" — together with the water circulating pump, these pumps being bolted to the bottom of the lower half.

A single spur gear reduction is fitted at the front end of the crankshaft, through which is transmitted the drive to the airscrew. The pinion is driven from the crankshaft through a short shaft, having teeth at the inner end to engage an internally toothed flange bolted to the crankshaft, and at the outer end teeth engaging with teeth cut inside a part of the gear pinion. The use of this shaft prevents loads from the gear pinion coming on to the crankshaft. The gear wheels are carried on large size roller bearings, mounted in a substantial cast aluminium case.

The airscrew shaft is of large diameter, made of nickel chrome steel, and is flanged at the front end to take a metal airscrew. A double thrust ball bearing is contained in the gear casing to take thrust from the airscrew.

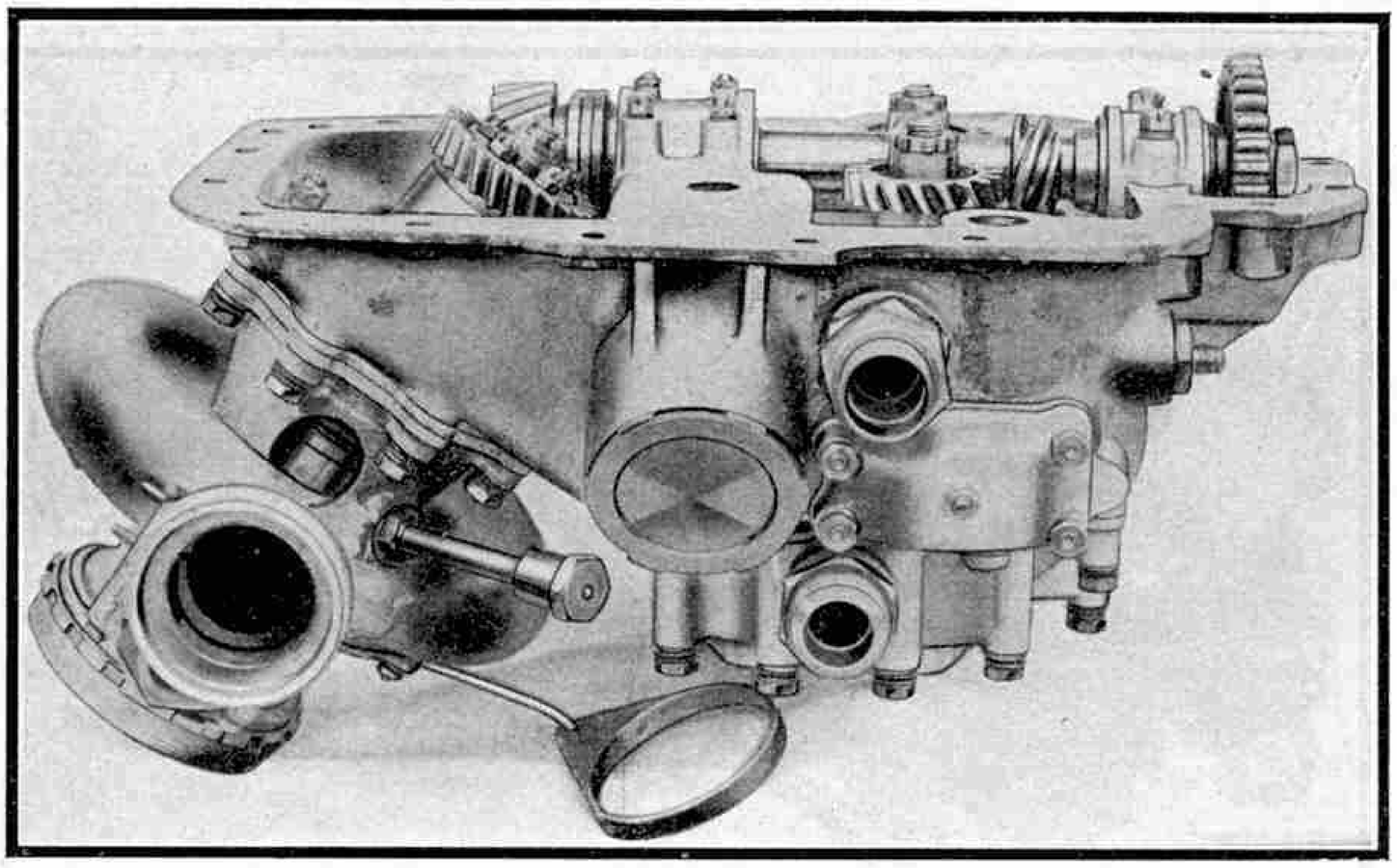
The design of the reduction gear is such that a special timing gear may be brought into operation and arranged to control the firing of a machine-gun through the propeller blades. This device, of course, is only fitted to engines that are to be used for military purposes.

A twin carburetter is provided, each half supplying one side of the engine. It is of a special Rolls-Royce Claudel-Hobson type, fitted with rotating valve adjustments by which the flow of petrol from float chamber to jet may be regulated from the pilot's seat to suit varying altitudes. Special compensating passages are provided in the carburetter, which maintain under all conditions the same pressure in the float chamber as in the throat, thereby neutralising

eddy current effects. These passages also enable the float chamber cover to be sealed, thus reducing the risk of petrol leakage. The carburetter is mounted low down at the rear of the engine, facilitating the use of gravity feed for the petrol system; and it is self-draining through the air intakes.

A large and convenient petrol filter is supplied with the engine as a separate unit.

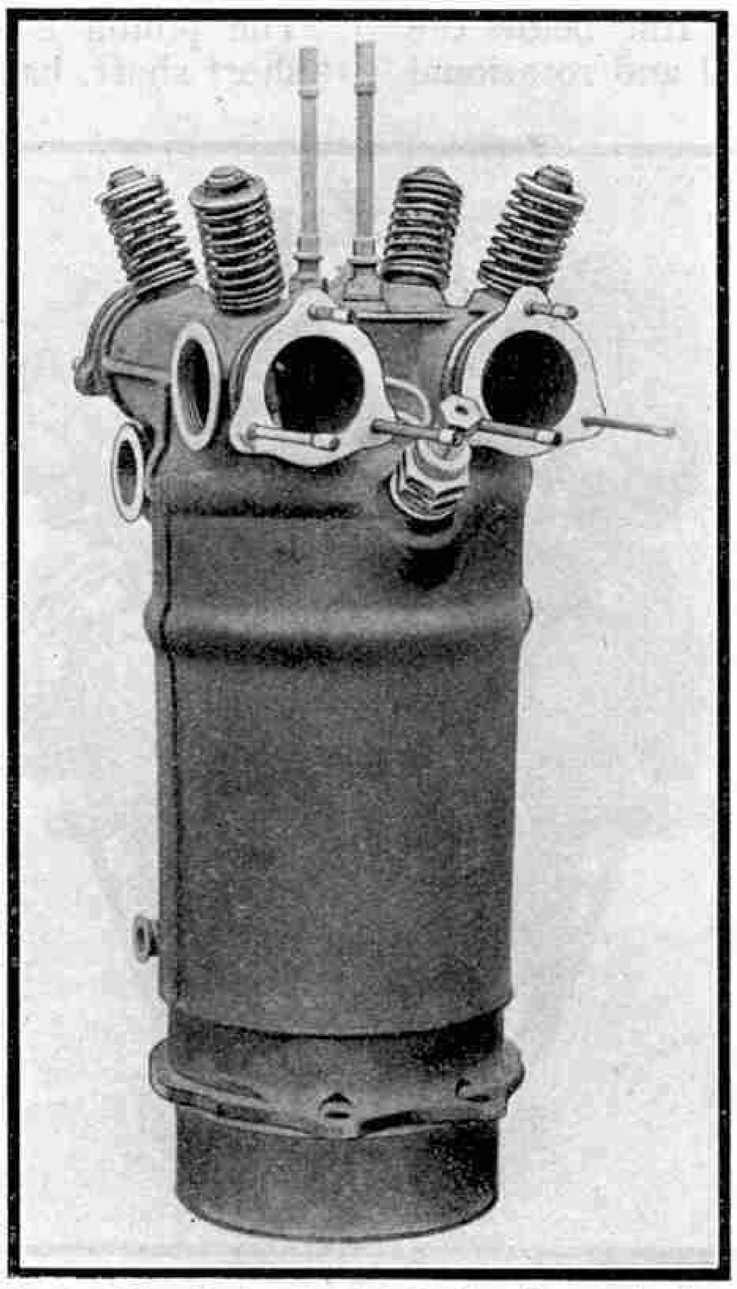
Two 12-terminal high-tension magnetos are fitted and are supported on the auxiliary gear case, from which they are driven by means of serrated couplings. Incorporated in the latter is a device for enabling a fine and positive adjustment of the ignition timing to be effected. Two sparking plugs are fitted to each cylinder.



The oil and water pumps and their gears. The large cap nut at the side is for one scavenger oil filter

A centrifugal water circulating pump of ample capacity is fitted below the bottom half crankcase and is driven from the auxiliary shaft through skew gears. All water pipe connections consist of special joints having rubber rings in compression where flexibility is required. In no case are rubber connections of the usual hose type employed.

The lubrication of the engine is on the "dry sump" system, the bulk of the oil being carried in a service tank separate from the engine. Two "scavenger" pumps and one "pressure" pump are arranged on the bottom of the lower half crankcase. The "scavenger" pumps draw oil from the crankcase and deliver it to the service tank, and the "pressure" pump takes its supply from the service tank and delivers it to the main bearings and other parts under suitable pressure. The "scavenger" oil pumps each have a coarse filter included in their casing, but the main filter for the "pressure" pump is supplied as a separate unit, which is easily taken to pieces for inspection without the use of tools. The pressure is regulated by means of a spring loaded relief valve.



A complete cylinder showing the four divergent valves. The sparking-plug-like object between the two valve ports is the starting gas connection

The control mechanisms for throttle and mixture regulator are fitted on the engine, the magneto control being inter-connected with the throttle control.

An interesting feature of the Condor engine is the novel method provided for suspending the engine. The airscrew end of the crankcase is fitted with two conical steel projections that are provided at their extremities with trunnions of cylindrical shape. The other end of the crankcase is slung from a pair of bell crank levers and pivoted on substantial brackets cast on the crankcase.

One leg of each bell crank projects vertically downward, the ends being coupled together by a rod that passes through a tube in the lower half of the crankcase. The other leg of each bell crank is horizontal and is carried by a pin on the other side of the main bearer tubes. Special rubber rings in compression are provided between the lower end of the bell cranks and the crankcase, and these restrain and damp the movement of this link system. Throughout the whole of the system a certain amount of play is allowed, thus giving the engine freedom to expand when heated up, which is a very necessary consideration in an engine of this size.

It is interesting to note that the dry weight of the "Condor" III with carburetters, magnetos, starting distributor and starting pipes, but excluding the reduction gear, is only 1,154 lb.

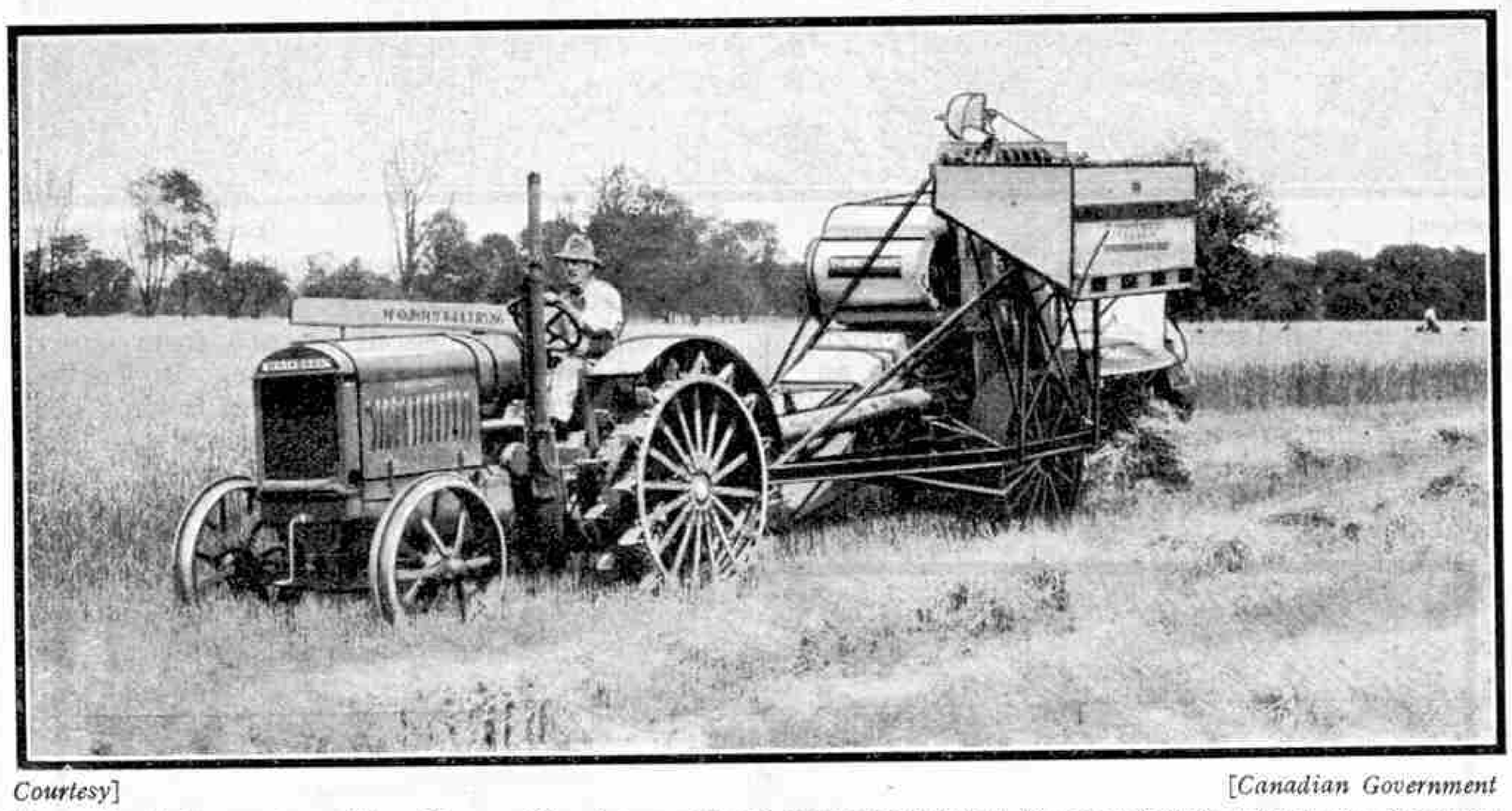
Rolls-Royce products have always been regarded as representing the highest possible standard of engineering, and as the principles that have made the name famous in the motor car world have also been followed in the construction of aero engines, it is not surprising that many important flights have been made by machines fitted with Rolls-Royce engines. The "Eagle" has the first direct Atlantic flight of 1919 to its credit, in addition to epoch-making aerial voyages to Australia and Capetown. Its successor, the subject of the present article, has proved of equal value in more recent record-making flights.

One of the most interesting of these was the organised Service cruise of sea aircraft to foreign capitals carried out last year. This cruise was a deliberate test of big flying boats in service conditions. Full equipment and complete crews were carried and the flying boats were independent of shore bases. Three of the boats were of new types. These were the grey-hulled (*Continued on page* 827)

IV.—WHERE THE WORLD'S WHEAT IS GROWN

WHEAT has been named the aristocrat of the grain world. As a food it is superior in flavour to all other grains and it is rapidly replacing rye as the chief ingredient of the flour used for bread-making in many of the more backward countries of Europe. Even in China and the Far East it is steadily coming into favour, and Asiatic peoples are using it on an increasing scale to afford a change from the everlasting rice.

Fortunately wheat is a very adaptable grain and may be grown successfully in many parts of the world. From its original home in Western Asia it spread rapidly over the whole of the civilised world, and also found its way to America shortly after the discovery of that continent. It is said that a negro slave belonging to the Spanish conqueror Hernando Cortes accidentally carried the grain to Mexico along with rice brought from Spain, while a Flemish monk is supposed to have brought from Ghent the first wheat grown in South America, soon after the conquest of Peru.



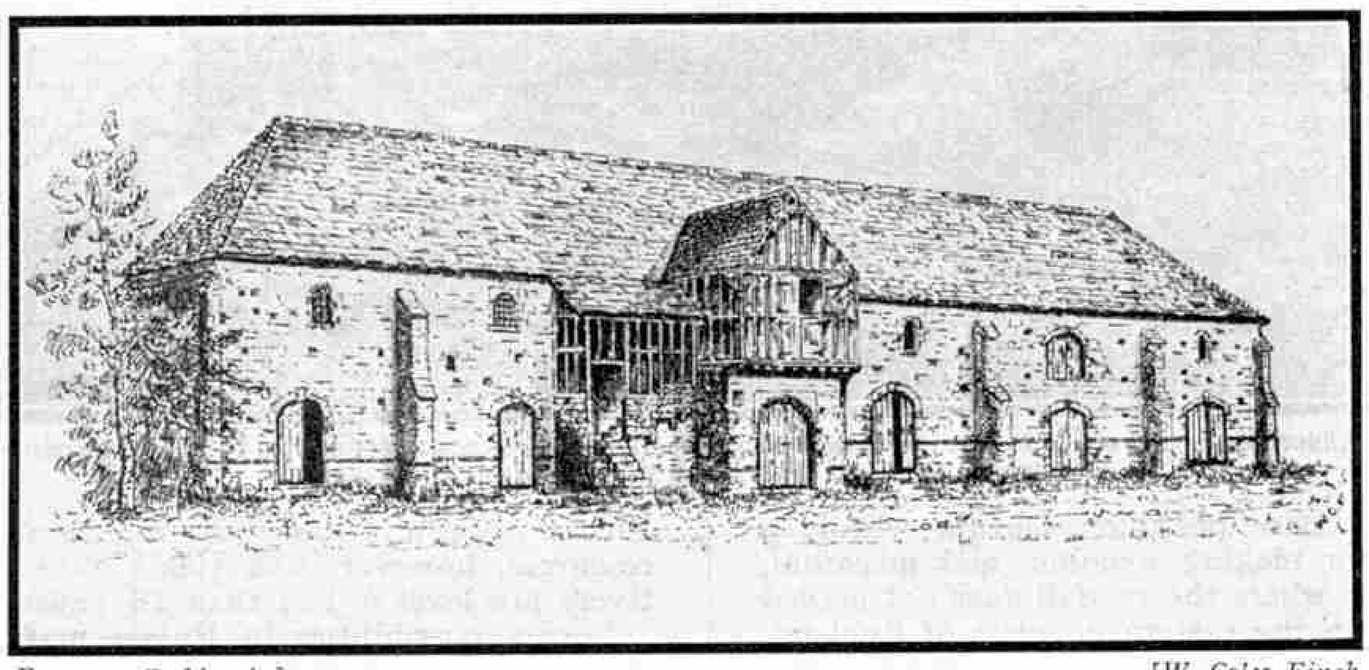
Courtesy] [*Canadian Government*

Harvesting in the modern style. The machine shown will cut, harvest and thresh 50 acres of grain daily in one operation at one third of the cost of older and more picturesque methods

Varieties of wheat are now known that enable the grain to be cultivated in countries with widely differing climates. Some forms may be grown in semi-tropical conditions, while others have been developed that have a very short growing period and are thus adapted to the restricted summers of the colder temperate regions.

Certain countries are specially suitable for wheat-growing on a large scale, and as they are capable of producing more wheat than they require for domestic consumption they have become the granaries of the modern world. Foremost among them are Canada, the United States and the Argentine Republic. In 1924 these three countries exported between them 528 million bushels of wheat. Of this huge total Canada's share was 216 million bushels, the contributions of the other two countries being practically equal. In the same year the surplus crops of Australia and India amounted to 60 and 28 million bushels respectively, the Australian figures showing an advance on the totals for previous years.

One result of the widespread distribution of wheat is that it is always harvest-time somewhere in the world, and the flow of wheat to the mills never ceases. The British crop is gathered in August and September, while in the northern countries of Europe the harvest extends to November. Wheat from the Argentine Republic and from Australia then makes its appearance, the harvest season in those countries extending from November and December into the following February. The Indian crop ripens a little later and fills in the gap between the last of the Australian grain and the first wheat from North America. The range of climate from Texas to Northern Saskatchewan and the Peace River settlements in Alberta is very great indeed, and thus a prolonged harvest season characterises North America. Texas wheat ripens in June, and harvest time is progressively later in northern districts. The earliest Canadian wheat ripens in July, while in some districts of both countries the season extends as late as September. It will be seen that this brings us round once more to the time of harvest in Great Britain.



From an Etching by] [*W. Coles Finch*

A thirteenth century tithebarn at Maidstone

The great days of agriculture in Great Britain were in the middle of last century. In 1857 more than four million acres were planted with the grain and the average annual production at that time

was 112 million bushels. A great decline then set in. Fifty years later the production had fallen to half this quantity, and the process of reduction has continued ever since. In 1925 the area devoted to wheat-growing was only 1,574,000 acres, yielding a total of 52 million bushels.

The causes of the decline are easily found. The grain can be grown more cheaply in the rich prairie lands of North America, and the growth of shipping has made its importation in sufficient quantity quite easy. In addition, the wheat grown in Canada is harder and of much better bread-making quality than English wheat. This difference in quality is reflected in price, the market value of hard wheat grown in Manitoba being higher than that of new English grain. It is only in exceptional circumstances that wheat is now grown in Great Britain on anything approaching the scale of 70 years ago. During the latter years of the Great War, for instance, the impossibility of importing sufficient wheat led to a great extension of wheat growing, the production rising to no less than 88 million bushels in 1918. It is very improbable that such an output will ever be attained again.

Courtesy] [*Canadian Government*

Harvest Time in Canada. Miles of wheat sheaves drying in preparation for threshing

Wheat may be divided roughly into two classes, spring wheat and winter wheat. The former is sown in spring, as its name suggests, and ripens in periods of from 90 days upward. Winter wheat is a stronger and harder variety that is capable of withstanding the hardships of a temperate winter. Its growing period extends over 225 days, and although there are many days in winter when the plant is at rest, it is thus capable of giving a heavier yield. The general requirements of the growing wheat plant are 50 days of fine weather and an average temperature of 66°F., while a yearly rainfall in excess of 33 inches prevents it from becoming a regular crop.

An Albion Binder at work in India. An interesting photograph for which we are indebted to Messrs. Harrison McGregor & Co. Ltd., Leigh, and Messrs. Joseph Collis, Strood

As already stated, however, wide variations from these average conditions are now possible. Durum wheat, a type that is largely grown for making semolina and macaroni, succeeds quite well in districts where the rainfall does not exceed 12 inches, while the average in the eastern counties of England, where very heavy yields per acre are obtained, is 22 inches. The rain is required chiefly in the spring and is not really necessary after the ear has shown itself. Fortunately the long, deep roots of the plant enable it to survive heavy drought.

The peculiarity of wheat in regard to water supply makes it a crop that succeeds well on irrigated land. This has been shown in India, where the cultivation of the plant is practically dependent upon artificial supplies of water. Irrigation works have been established on a large scale in the Punjab and the United Provinces, with the result that to-day India is one of the great wheat-producing countries of the world. The Asiatic tendency to replace rice by wheat is nowhere more noticeable than in this country, however, and only 10 per cent. of the crop is available for export. Most of this passes through the port of Karachi, in the Delta of the River Indus, and on that account Indian varieties of wheat are usually referred to by millers as Karachi wheat.

The kind of soil that is best suited for the growth of wheat is a heavy loam, lower yields being obtained from sandy soil on the one hand and from heavy clay land on the other. Great variations in the yield per acre occur. These are not due entirely to differences of soil, but temperature and rainfall also are largely concerned. Another important factor is the method of agriculture. The best agricultural practice is followed in England, where the land has long been under cultivation and the lessons learned from experience and experiment have been put to practical use. In England a scientific rotation of crops is followed. The land is kept clear of weeds, and such important plant foods as nitrogen and lime are added to it by the use of both natural and artificial manures. Good yields are obtained, the average being as much as 31 bushels per acre.

The productivity of English soil may be contrasted with that of the Russian and Canadian wheat-growing areas. Russian wheat grows in the famous black earth district north of the Black Sea. The soil contains from 4 to 16 per cent. of organic matter, or humus, formed by the decay of leaves from the trees of the huge forests that formerly characterised this region. The natural fertility of the soil is aided by a precipitation of 22 in., a very suitable amount that falls chiefly in the form of snow. The crude agricultural methods of the Russian peasants have not increased the value of the natural resources, however, and yields have remained at the comparatively low level of less than 10 bushels per acre.

Future possibilities in Russia may be gauged from the fact that 880 million bushels of wheat were produced in 1913, of which 122 million bushels were exported. In spite of the low yield per acre, this figure is far in excess of the quantity produced to-day in the United States, the world's largest wheat-producing country. The Great War, and the political troubles that followed caused a great decrease, and in 1924 only 333 million bushels were grown. Two years later this was increased to 576 million bushels, however,

Courtesy] [*"The Times"*

Harvesting on the Sussex Downs. A picturesque scene near Lewes

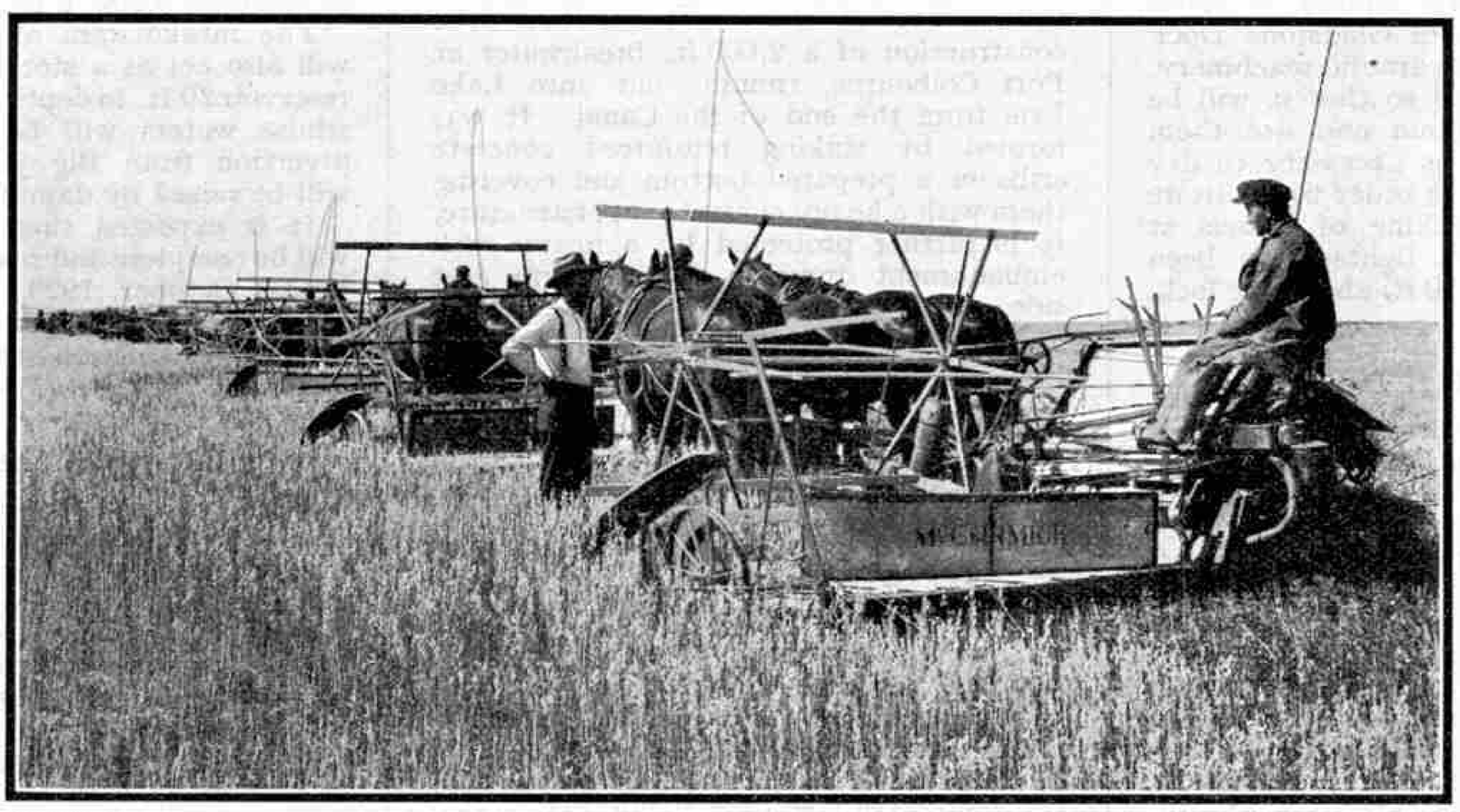
and it seems probable that Russia will once more become a great wheat-producing country. At present rye is the dominant crop.

Turning now to Canada, where wheat is being grown on an increasing scale, we find that the yield per acre in 1925 was 19 bushels. This figure was exceeded during the four years from 1909 to 1913, but is greatly in excess of the average for the period from 1920-1924, when the average volume of the crop was only 15.6 bushels per acre.

Two noteworthy features of Canadian wheat production are that the yield per acre is decreasing and that great variations are possible from year to year. The yield per acre is diminishing because the soil is being exhausted by the system of cultivation in use. On the broad lands of the prairie provinces wheat has so far been practically the only crop. The soil constituents necessary for the growth of the plant have been abstracted by successive crops, and the deficiency has not been made good by the system of allowing the land to remain fallow one year in three. The absence of a rotation system has also meant the non-cultivation of root crops that clean the land, and thus weeds seriously affect the food production. The cause of the variation in the yield is found in climatic conditions, and a very interesting chapter in the story of wheat has resulted from attempts to maintain a high level continuously. The climate of the wheat-growing belt of Canada is continental, and great variations in temperature are experienced. The summer is certainly warm, but frosts appear as early as August and persist in the spring, while from November to March the ground is completely frozen to a considerable depth. Thus the wheat plants are exposed to considerable risks at two critical stages—the first when the seed is sprouting and the second when the ear is ripening.

In spite of this threat from the climate, however, wheat-growing in Canada is a prosperous occupation. The area in which the plant is grown is continually extending, even northward, and the total production is rapidly increasing. The 1925 crop totalled 417 million bushels, that of last year amounted to approximately 450 million bushels, while the increase in the acreage under wheat this year has led some experts to anticipate a crop of no less than 550 million bushels.

This great increase has been made possible by careful and prolonged experiments on varieties of wheat in order to produce new kinds that possess a shorter growing season. Two methods of improving breeds of wheat are possible. In one advantage is taken of the fact that a field of wheat of any one kind shows great variations, some of the plants having larger ears and a shorter growing period than others. By continually selecting seed for the following year from the best ears only, the variety may be greatly improved. To prevent being misled by exceptional circumstances, such as the variations in soil, the wheat is judged by the quality of the plants descended from it, and not by its own apparent merits.

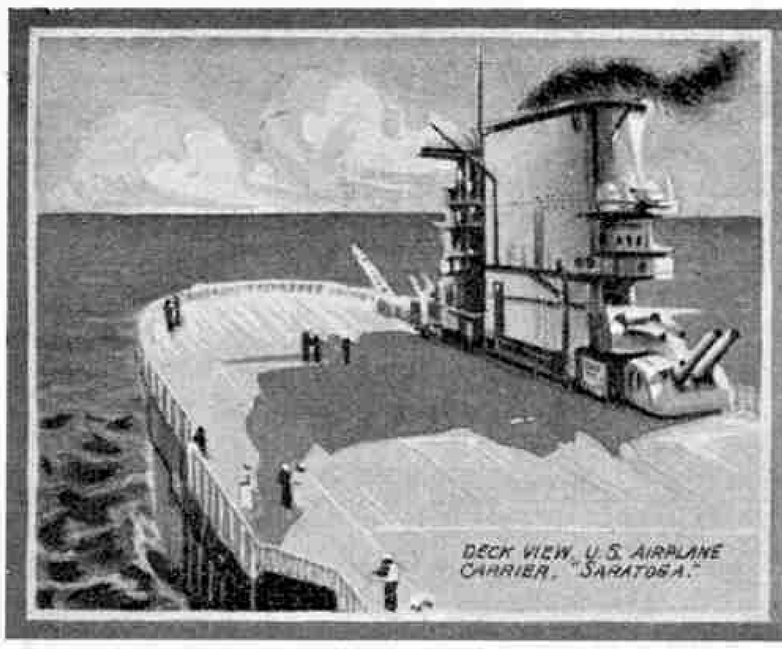


Courtesy] [*Canadian Government*

Large scale farming operations. A battery of twelve binders at work

The second method of improving plant breeds is more interesting. As an illustration, we may note the origin of "Marquis," the variety of wheat that has been most largely grown in Canada in recent years. Before its introduction the variety known as "Red Fife" was greatly favoured. This has excellent milling qualities, but the length of its growing season makes it liable to be caught by early frosts. In the hope of producing a variety with the good qualities of "Red Fife" that would at the same time ripen earlier, this wheat was crossed with "Hard Red Calcutta," a wheat that grows more quickly. The crossing was accomplished by fertilising the flower of one variety with pollen from the other.

The seed produced by crossing plants in this manner is always a very mixed collection, but it is often possible to select varieties that inherit the good qualities of the original plants. It was so in this case. After repeated trials it was found that one of the descendants of the two varieties combined the merits of both without introducing any defects. This variety was named "Marquis," and became the standby of the Canadian wheat farmer.



ENGINEERING NEWS

Birkenhead Dock Improvements

A new 80 ft. river entrance lock leading to the Alfred Dock on the Birkenhead side of the Mersey was recently opened by the Right Hon. the Earl of Derby, K.G. The lock is 600 ft. in length and 40 ft. 4 in. in depth at average high water level of Spring tides. This is an increase of 3 ft. 9 in. on the previous maximum depth, and will enable vessels bound for India and the Far East to be loaded to the maximum draft that can be taken through the Suez Canal. When necessary, the lock can be sub-divided into two compartments, 400 ft. and 200 ft. in length respectively.

The lock possesses three pairs of steel gates, each leaf being over 200 tons in weight. They are similar to those in use at the Liverpool Gladstone Dock and are operated by hydraulic machinery. The gates are designed so that it will be possible to reverse them and use them as dams whenever it is necessary to dry the lock for repairs. In order to facilitate the locking and unlocking of vessels at night, electric beacon lights have been erected at a height of 90 ft. above the lock.

* * * *

British Columbia Port Development

Construction of the first unit of the new docks at New Westminster, B.C., on the Pacific coast, was recently commenced, the inauguration ceremony taking place in the presence of the Hon. Dr. J. H. King, M.P., Dominion Minister of Health, and Sir Henry Thornton, President of the Canadian National Railways. The project includes the provision of a cold storage building four storeys in height and the extension of the wharf of the Fraser River Dock and Stevedoring Co. Ltd., by 1,000 ft. to provide a total berthing space of more than 3,000 ft.

Another interesting project in connection with the development of New Westminster as an ocean shipping port is the building of a million-bushel grain elevator and a loading wharf 1,100 ft. in length. This will be the first elevator on the Fraser River, and ample scope for development of the expected grain traffic is provided on the south side of the river where 12 acres of land have been reclaimed. The site also includes 60 acres on shore. Two ships will be able to berth at the wharf, alongside which there will be a depth of 32 ft. at low water.

* * * *

Welland Ship Canal nearly Completed

According to a report by the Engineer-in-charge of the new Welland Ship Canal, issued by the Canadian Department of Railways and Canals, this great new waterway is expected to be ready for traffic by 1930. Up to 31st March last, over £23,500,000 had been expended on the project, the completion of which involves a total expenditure of £30,000,000. The Canal is to link Port Colbourne on Lake Erie with Port Dalhousie on Lake Ontario, and is virtually a straight line throughout its length of 25 miles. It has locks capable of taking vessels with a draught of 30 ft.

Lock No. 8, the last on the Lake Erie end of the undertaking is the longest in the world, being 1,380 ft. in length between its inner gates. Its only rivals are two locks on the American side of the Sault Ste. Marie Canal, both of which are 1,350 ft. in length.

The most notable engineering feat in the cutting of the canal has been the construction of a 2,000 ft. breakwater at Port Colbourne, running out into Lake Erie from the end of the Canal. It was formed by sinking reinforced concrete cribs on a prepared bottom and covering them with a heavy concrete superstructure. It is further protected by a heavy rock embankment dumped on the south east side.

There remains little to be done on the Canal proper, though works incidental to its operation have yet to be undertaken, including the construction of two bridges, and a supply weir to control the flow of water into the new Canal from Lake Erie.

* * * *

Growing Traffic of the Port of Beira

The improvements in wharf accommodation and equipment at the port of Beira have coincided with a great increase in traffic through the port. The total number of ships arriving is increasing steadily, the figure for last year being 594, representing a gross tonnage of well over 2½ millions. In 1924 the tonnage dealt with over the railway piers was 445,259; last year the corresponding figure was 598,674 tons, which is a remarkable increase in the time. Including traffic dealt with at the customs wharf, the total cargo landed and shipped last year amounted to 682,000 tons.

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More Water for Manchester

The Manchester Corporation have provided for the augmenting of their existing water supply from Hawes Water in Westmorland. This lake has a water surface of 346 acres and a drainage area of 8,000 acres. The Corporation propose to construct a dam across Hawes Water Beck. The reservoir will then have a water surface of 1,000 acres and a drainage area of 24,000 acres, and will hold 19,000,000,000 gallons of water.

Hydro-Electric Development in Nova Scotia

The Nova Scotia Power Commission has signed a contract with the Foundation Company Limited, of Montreal, for the construction of a hydro-electric power plant to operate the new 250-ton newsprint paper mill to be constructed near Liverpool, Nova Scotia, by the Royal Securities Corporation. The initial power undertaking calls for the annual delivery of 105,000,000 kilowatt hours at the rate of 20,000 h.p. The cost of the entire scheme is estimated at £915,000, and there will be three separate stations at Upper Lake Falls, Lower Lake Falls and Big Lake Falls. Further capacity will still be available in Liverpool itself for the ultimate additional provision of another 6,200 h.p.

The intake dam of Upper Lake Falls will also act as a storage dam to create a reservoir 20 ft. in depth on Lake Rossignol, whose waters will be supplemented by diversion from Big Jordan Lake, which will be raised by damming.

It is expected that the three stations will be complete and ready to deliver power by 1st October, 1929, and the paper mill should be in a position to undertake commercial production not later than 1st January, 1930.

* * * *

London's Arterial Roads

With the recent opening of the Bexley Heath by-pass road another link in the great chain of arterial roads around Greater London has been forged. The road is slightly more than 5½ miles in length and has an average width of 80 ft. with a central carriageway 30 ft. in width.

An interesting feature of the road is that it has been constructed of concrete in 32 sections, each section varying slightly in one way or another from the remaining sections, so that experience of the relative durability of differing methods of construction may be gained.

The total cost of the road is approximately £309,000.

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Automatic Electric Power Plant

A remarkable electric power plant has recently been brought into service at its factory by a Swedish private company. It is automatic in action and is actually started and controlled from a telephone switchboard situated in the factory office some little distance away.

Technical details of the plant are not yet available but it is stated that the installation is operating perfectly, and that the company contemplate replacing other of their power plants with the new system of working. It is claimed that this is the first automatic electric power plant in Europe.

The Southampton Dock Extensions

The recent grant of Parliamentary powers to the Southern Railway Company for a large scheme of dock extensions at Southampton calls attention to the rapid growth of the port and its docks within recent years. Although the port of Southampton has existed as such for many hundreds of years—the English army embarked there for Poitiers and Crecy—it is only within comparatively recent years that it has taken its rightful place in the shipping world.

The Outer Dock, which was the first one to be put into use, was opened in 1842, when the population of the port was 28,000. The Inner Dock was opened in 1851 and is the only basin in the port that is not tidal, being separated from the Outer Dock by a single pair of gates. During the nine years that elapsed between the opening of these two docks, the population increased to 35,300, and in 1875, when the first extension was opened, the population was 57,000. When the last census was taken the official figure was 160,997.

The recently authorised scheme involves the reclamation of 407 acres of mudland at an estimated cost of £13,000,000. This mudland at present forms a bay about two miles in length and half a mile in width in the River Test, and extends from the Royal Pier to Millbrook Point. A deep water quay wall, 7,400 ft. in length, is to be constructed, and the berths and approach channels are to be dredged to provide a depth of 45 ft. over an average width of some 500 ft. Six cargo sheds, each 1,000 ft. in length by 120 ft. in width, are to be constructed, and at some future date a jetty 5,000 ft. in length and 400 ft. in width will be built at a distance of 600 ft. from, and parallel to, the quay. This will give facilities for the berthing of over 20 additional vessels, and will have rail connections to the Southern Railway's main lines.

On the opposite side of the Royal Pier another 120 acres of mudland are to be reclaimed, and a new quay wall over 400 ft. in length is to be constructed between the Pier and the Town Quay.

Work has already commenced on the deep water quay facing the River Test, the contract for this work having been let to Sir Robert McAlpine & Sons. The construction of the wall will necessitate the use of nearly 700,000 tons of material and will take approximately four years to complete. The first portion, 1,000 ft. in length, will be available for use within two years.

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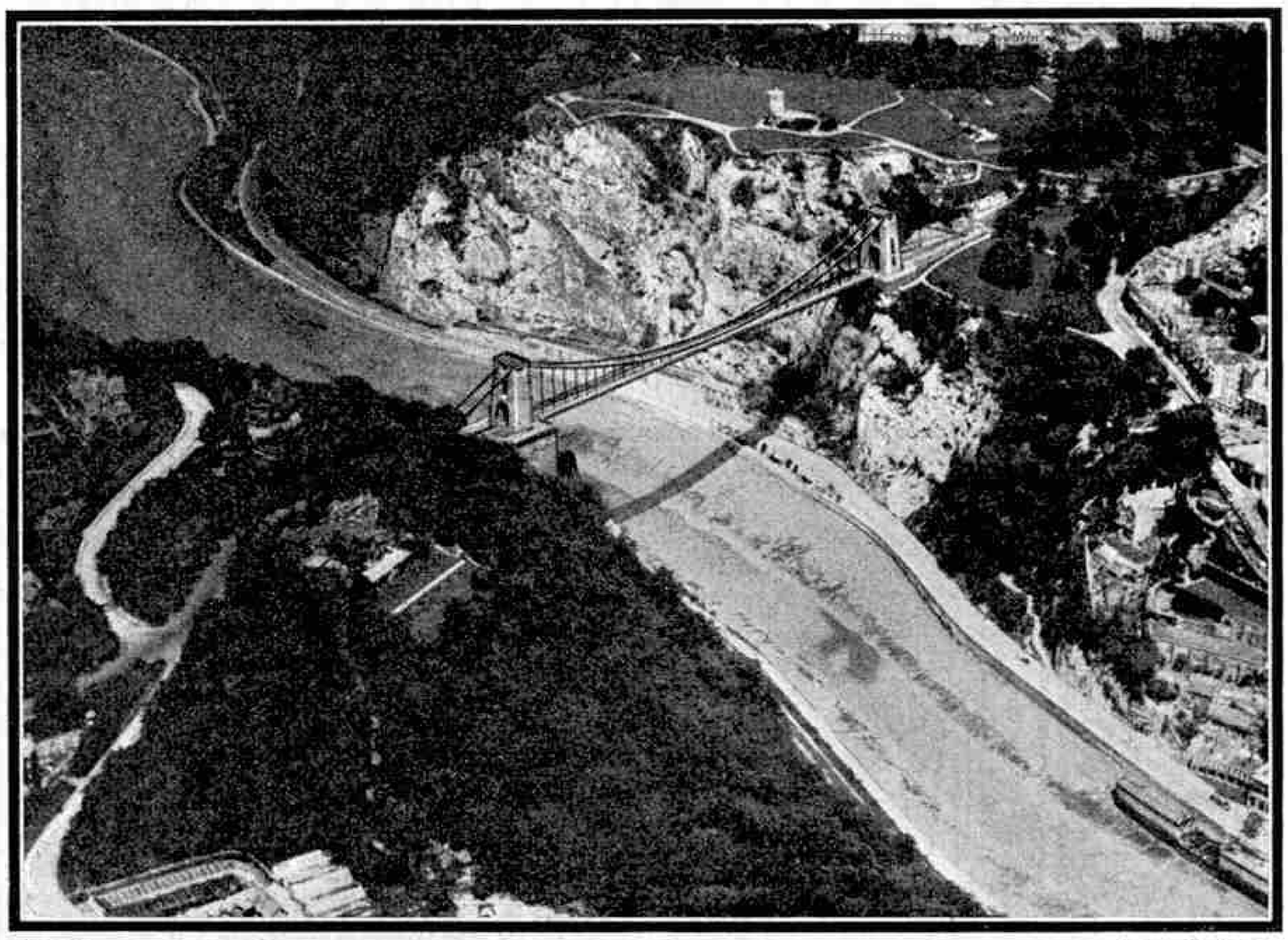
Work has been commenced upon a new Leeds Corporation power plant at Redcote Farm, near Kirkstall, Leeds. The estimated cost of the project is £3,000,000.

Bridges from the Air: No. 4



Photo] [*Aerofilms Ltd.*

Designed by Brunel and built between the years 1832 and 1864, the Clifton suspension bridge has a span of 702 ft. It crosses the gorge of the river Avon at a height of 245 ft. above high water

The New German Liners

Further particulars regarding the two new German liners, the "*Bremen*" and the "*Europa*" designed for fast Atlantic traffic are now available. It is stated that the length of these vessels is 938 ft. and that they have a breadth of 108 ft. and a draught of 32 ft. 7 in. It is not clear whether the length is that between perpendiculars or the overall measurement. If the former, the new vessels will be the longest yet launched, but their length will be exceeded by the new White Star liner now being built at Belfast. If the figure is the overall measurement, however, then the new vessels will be shorter than the "*Majestic*," which has an overall length of 956 ft. Further points of interest are that the breadth of the German ships exceeds that of the "*Majestic*" by more than 8 ft. whereas their draught is over 6 ft. less.

* * * *

It is announced by the Public Works officials at Port Arthur, Ontario, that the dock at the plant of the Thunder Bay Paper Mill has now been completed. The dock, which has a depth of 23 ft. of water and is 150 ft. in width, has been cut from earth and solid rock, and extends inland to a point 650 ft. from the waterside.

Progress of Canadian Motor Car Industry

According to a report recently issued by the Canadian Bureau of Statistics, Canadian automobile manufacturers produced in April 24,240 cars, an increase of 39 per cent. over the figures for March. The April figures are only slightly below those for the same period last year and are an indication that the outlook of the industry is becoming brighter. In April of last year 24,611 cars were produced.

Automobiles imported into Canada during April numbered 5,150, as compared with 6,114 in the previous month and 4,917 in April, 1927.

* *

Private Motor Road from London to Brighton

A British syndicate operating under the name of Motor Roads Limited, has recently been formed to construct a number of privately-owned motorways in Great Britain, and proposes to build its first road between London and Brighton. This would consist of two one-way roads, which would be 60 ft. in width at their narrowest point and 100 ft. at the widest point. The suggested road would run from the Kingston by-pass road and probably would terminate at Patcham, passing through Epsom, Reigate and Horsham en route. The road would be constructed of reinforced concrete and its estimated cost would be £3,000,000.

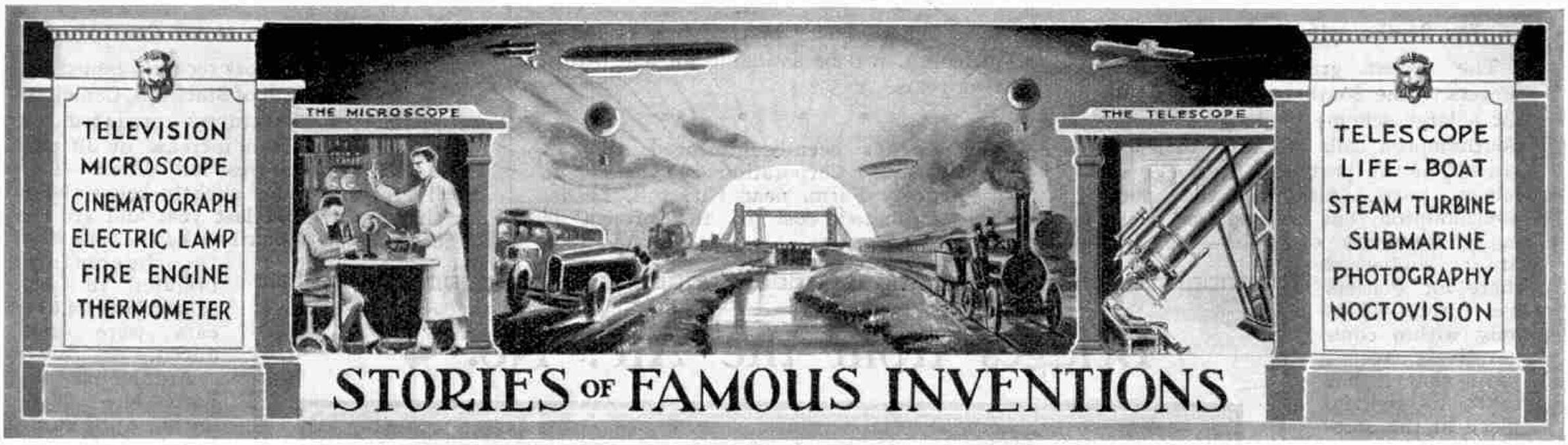
Some method of dividing the road into segments would be put into practice in order to keep heavy lorries, motor coaches, and private cars apart. Private cars would be charged a toll of approximately one farthing a mile, but for heavier traffic a slightly higher sum would be demanded.

The company have in mind the possibility of constructing similar roads to Portsmouth and Southampton.

* * * *

Ship Despatch Record for Montreal

What is claimed to be the fastest piece of stevedoring work ever accomplished was carried out at Montreal recently, when the British steamer "*Linkmoor*" was loaded with 186,392 bushels of wheat in 3¾ hours. The "*Linkmoor*" was given the quickest despatch ever achieved in the Port of Montreal. While it was unloading 4,570 tons of anthracite coal from Wales, the vessel was being fitted for carrying wheat, and in less than 74 hours from entering the Port, was under way again.



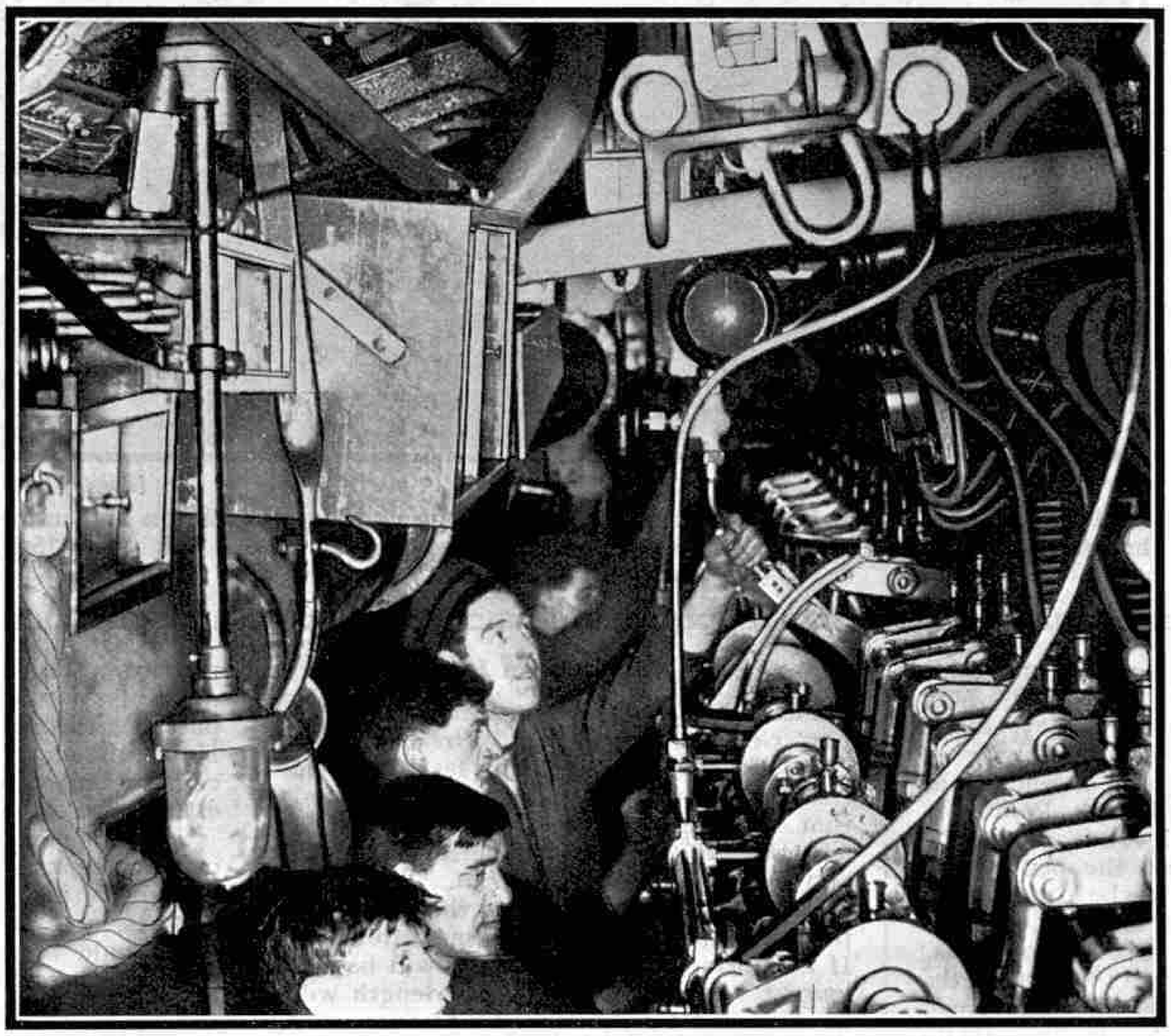
VI.—THE SUBMARINE

THE story of the development of the submarine from the crude inventions of Drebbel, Day and others to the powerful and efficient submersible craft of the present day has been related in the two previous articles in this series, and we now come to a description of the construction of a modern vessel and of the remarkable equipment that it contains.

The hull of a modern submarine is surmounted by a deck that extends for roughly one half of the length of the vessel and carries the gun superstructure and the conning tower. This tower is surmounted by the navigating bridge on which are the compass, the steering wheel and other navigation instruments, and this equipment is used when the submarine is cruising on the surface, but is transferred to the interior of the vessel before it submerges. The conning tower is capped by a small dome-shaped hatch hinged like a lid.

When a submarine is about to be submerged the navigating officer takes a last look round from the bridge to make certain that the immediate vicinity of the submarine is free from any obstruction, and then descends into the submarine by way of a steel ladder inside the tower. The hinged roof is then pulled down and it fits so closely into place as to form an absolutely watertight joint.

The conning tower is built upon the hull of the vessel and in the floor of this tower is a second hatch which, when closed, renders the interior of the submarine completely watertight.



Auxiliary machine room of a "K" class British submarine showing the enormous amount of mechanism contained in such a small space

The vessel can then submerge in safety, for if the conning tower should become damaged by gun fire or otherwise the closed lower hatch ensures that the interior of the vessel remains intact. When both the hatches are closed the tower also becomes a self-contained watertight compartment.

Inside the conning tower is a small compartment in which is the eye piece of the periscope, together with the compass, recording instruments and the telegraph instruments for communicating with the different parts of the submarine. Several ports or windows in the side of the tower enable the navigating officer to scan the surrounding sea until the vessel, in its descent, shuts off the view. He then utilises the periscope, unless for some special reason the submarine descends to a depth greater than the length of the periscope, in which case the hood of the latter is closed before becoming submerged. When the periscope is closed in this manner the submarine becomes totally blind, and if it is necessary for the vessel to travel in this condition steering has to be carried out by compass.

The periscope tube is the most conspicuous feature of a submarine and the simple contrivance that it accommodates is very ingenious. The first periscope to be installed in a submarine consisted of a tube fitted at the top and bottom with a mirror set at an angle at 45 degrees to the perpendicular. The view received by the top mirror was reflected down the tube to the bottom mirror, where the navigator was able to see it. In spite of careful adjustment, however, the view received by the bottom mirror in this apparatus was always blurred and incomplete. At a later date prismatic glass reflectors were adopted in place of the plane mirrors, and the instrument now in use is a combination of these two earlier methods.

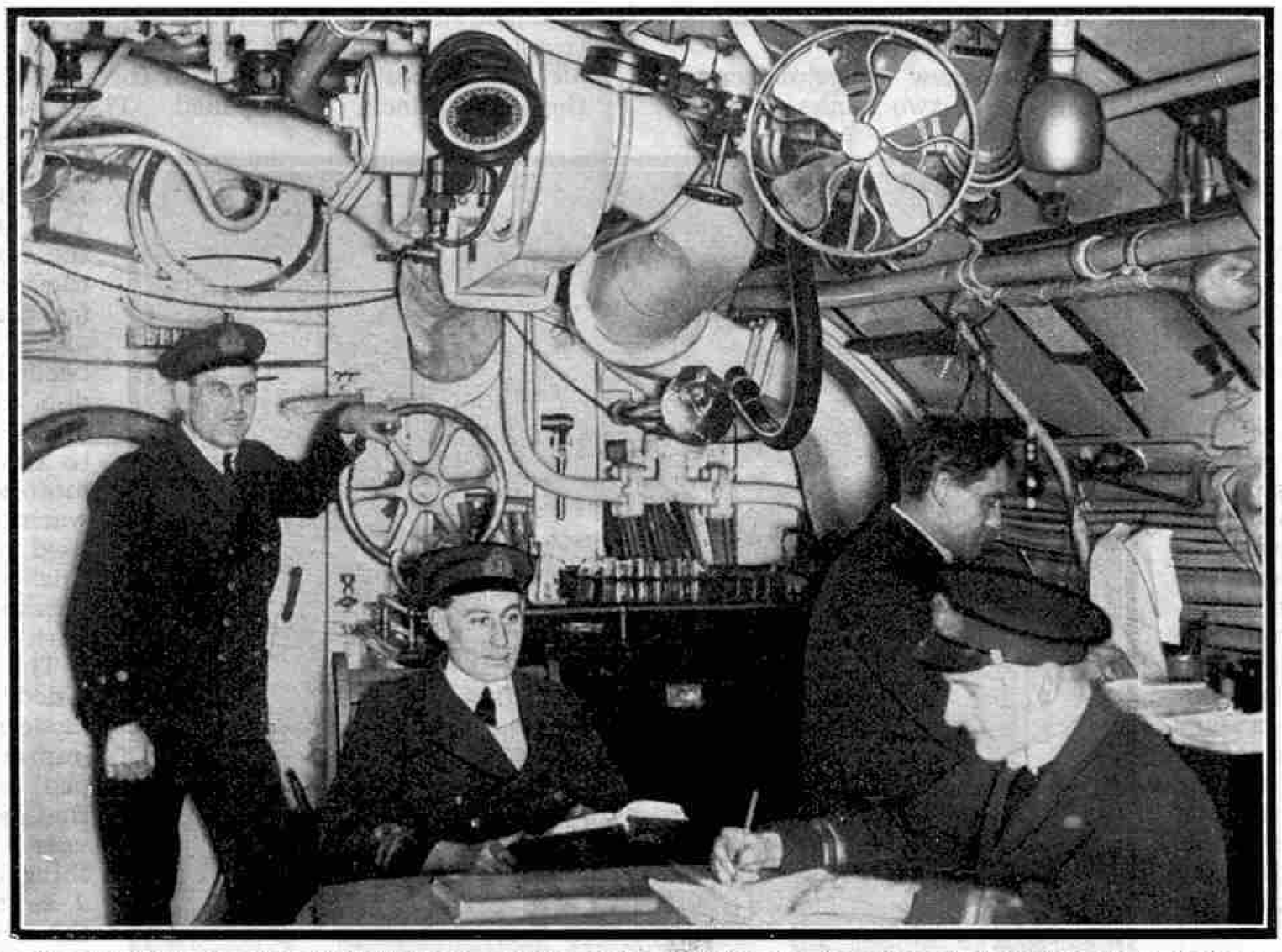
The tube of a modern periscope is approximately 20 ft. in length and contains about 16 lenses and prisms. The tube is erected vertically and extends for many feet above the conning tower, while the base is inside the navigating compartment of the tower. It is mounted inside a protecting sheath in which it can be rotated.

The early periscopes were enclosed in a watertight stuffing box fitted in the roof of the conning tower, but although this arrangement allowed the tube to be rotated when the vessel was at a standstill, the resistance of the water made it a very difficult task to perform when the vessel was cruising. This difficulty has been overcome by enclosing the periscope in a fixed outer cover which, by resisting the pressure of the water, enables the tube to be rotated easily and quickly. An additional advantage of the arrangement is that the inner tube, with its delicately adjusted lenses and prisms, can be drawn down into the vessel when desired. The periscope is rotated either electrically or by means of a handwheel.

The prism that reverses the image reflected downward by the eye of the periscope is carried in the lower half of the tube. This portion of the tube rotates with only half the angular velocity

of the top portion, the reduction being effected by means of gearing introduced midway down the periscope.

The torpedo tubes of a submarine are situated in the bow and at the stern of the vessel, and in consequence it is of the greatest importance that the navigating officer should not only have a view of the horizon but also be aware at all times of the situation of the submarine in relation to its objective. This latter requirement has been met by the introduction of two glass plates inside the periscope. One glass is indexed and is fitted in the revolving section of the periscope, while the other is imprinted with a calibrated circle and is fitted in the fixed section of the tube. When the submarine moves to one side or the other of a direct course, the angle of deflection is reproduced by the index glass and the extent of the angular movement is indicated by the calibrated plate, and a glance at the two readings is sufficient to inform the officer of the exact position of the submarine in relation to its intended course.

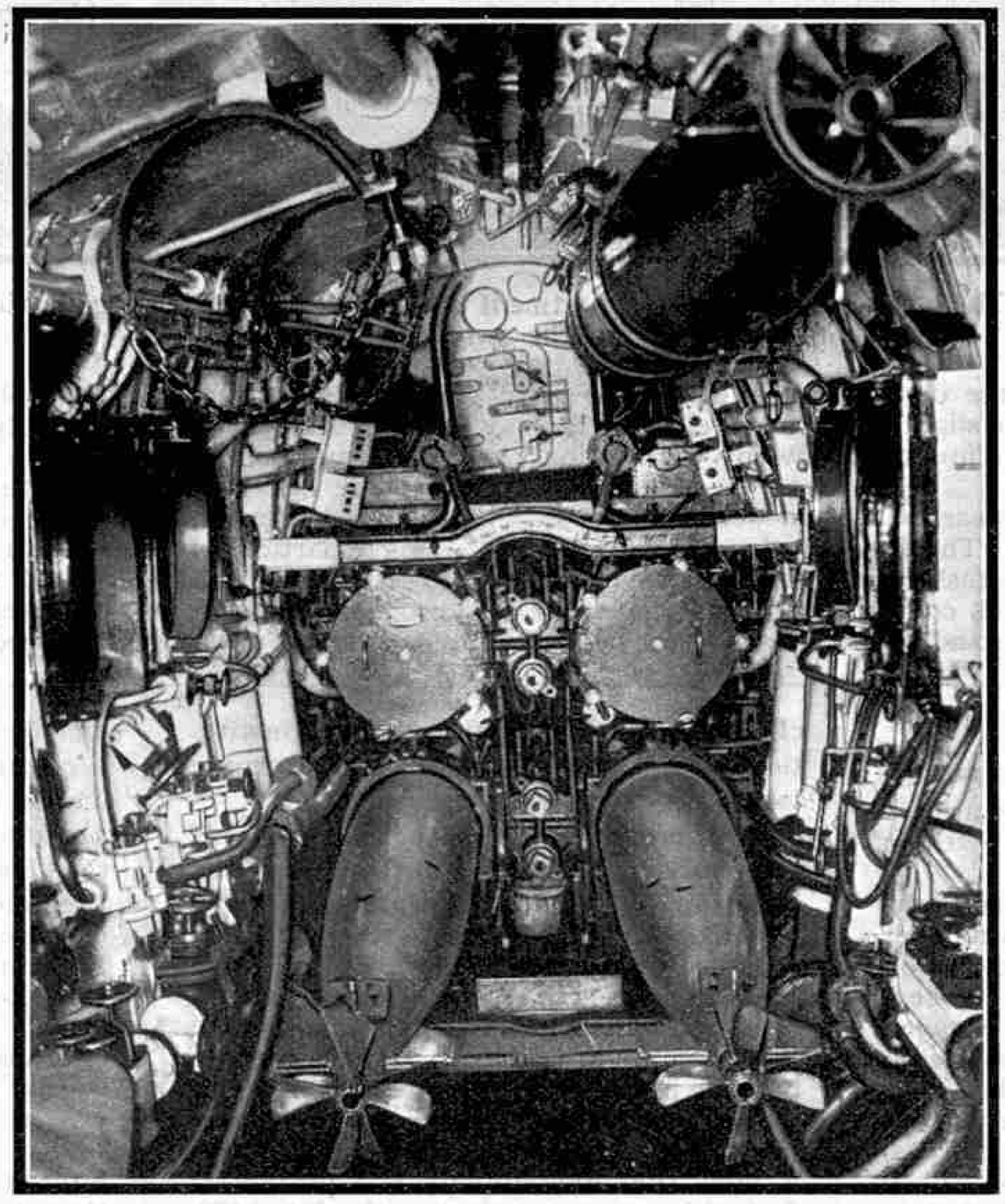


The wardroom of a "K" boat. Even here machinery is very evident but nevertheless a reasonable amount of comfort is provided

The great drawback of the ordinary periscope is that its maximum angle of vision in the horizontal plane is only 60 degrees. Thus, when the observer is directing the periscope in any given direction, he is unable to see what is going on over the other 300 degrees of the horizon. On one occasion at least a British submarine has been lost owing to being run into from behind by a liner. The navigating officer of the steamship failed to observe the narrow periscope of the submarine projecting above the water directly ahead of his ship, while the submarine periscope gave no indication of the great vessel coming up in the rear.

The interior equipment of a modern submarine is naturally a closely guarded secret, but sufficient details of early types have been disclosed to enable a fairly accurate idea of what a submarine is like inside to be gained. There is only one deck in the interior and this carries the torpedo chambers, navigation compartment, crew accommodation and engine room, while below deck are the storage batteries and the fuel and ballast tanks.

The earliest submarines were provided with a single torpedo tube in the bow. As larger and more powerful vessels have been built, the number of torpedo tubes has increased, and a modern submarine may contain as many as four bow torpedo tubes, four similar tubes at the stern, and two additional pairs of tubes, one each fore and aft of the conning tower. The torpedo tubes are always loaded before a submarine leaves port in order that they may be ready for immediate use. Additional torpedos are also taken on board and are stored in low wooden racks, or "cradles," near to the respective tubes through which the torpedoes are to be fired.



The fore-part of a submarine showing the bow torpedo tubes

To load a torpedo tube the circular door or breech block is unlocked by turning a small hand-wheel, after which the block is swung sideways. The torpedo is then swung off its cradle, lifted up and pushed into the tube, and the breech block is closed. The hand-wheel is then given a slight reverse turn by which the tube is effectually sealed. When the moment arrives for discharging the torpedo, a small cap that covers the mouth of the tube to keep out the sea is swung clear by means of electrically-controlled gear operated from the interior of the submarine, and after the torpedo has been fired the cap is restored to the mouth of the tube by the reverse operation of the gearing. The firing of the torpedo is carried out by means of compressed air, the passage of which, from the reservoir in which it is maintained at the required pressure, is controlled by means of a valve.

Behind the bow torpedo chamber and immediately beneath the connng tower is the navigation compartment, which contains a remarkable array of instruments and machinery. Here is a duplicate set of the navigating instruments housed in the conning tower compartment, together with steering wheels for operating the ordinary rudder and the horizontal rudders that project from the hull near the bow and astern. There are gauges to indicate whether the vessel is travelling on an even keel and to register the angle at which it ascends or descends. Between the navigating compartment and the engine room are the crew's quarters.

The propelling machinery and lighting plant are situated in the aft part of the submarine. The former consists of the oil engines for driving the vessel on the surface and the electric motors for underwater propulsion. In early submarines petrol engines were used for surface cruising, but explosions on several of the vessels brought home to the authorities the inadvisability of storing petrol in the limited space available in a submarine. The use of petrol-driven engines was aban-

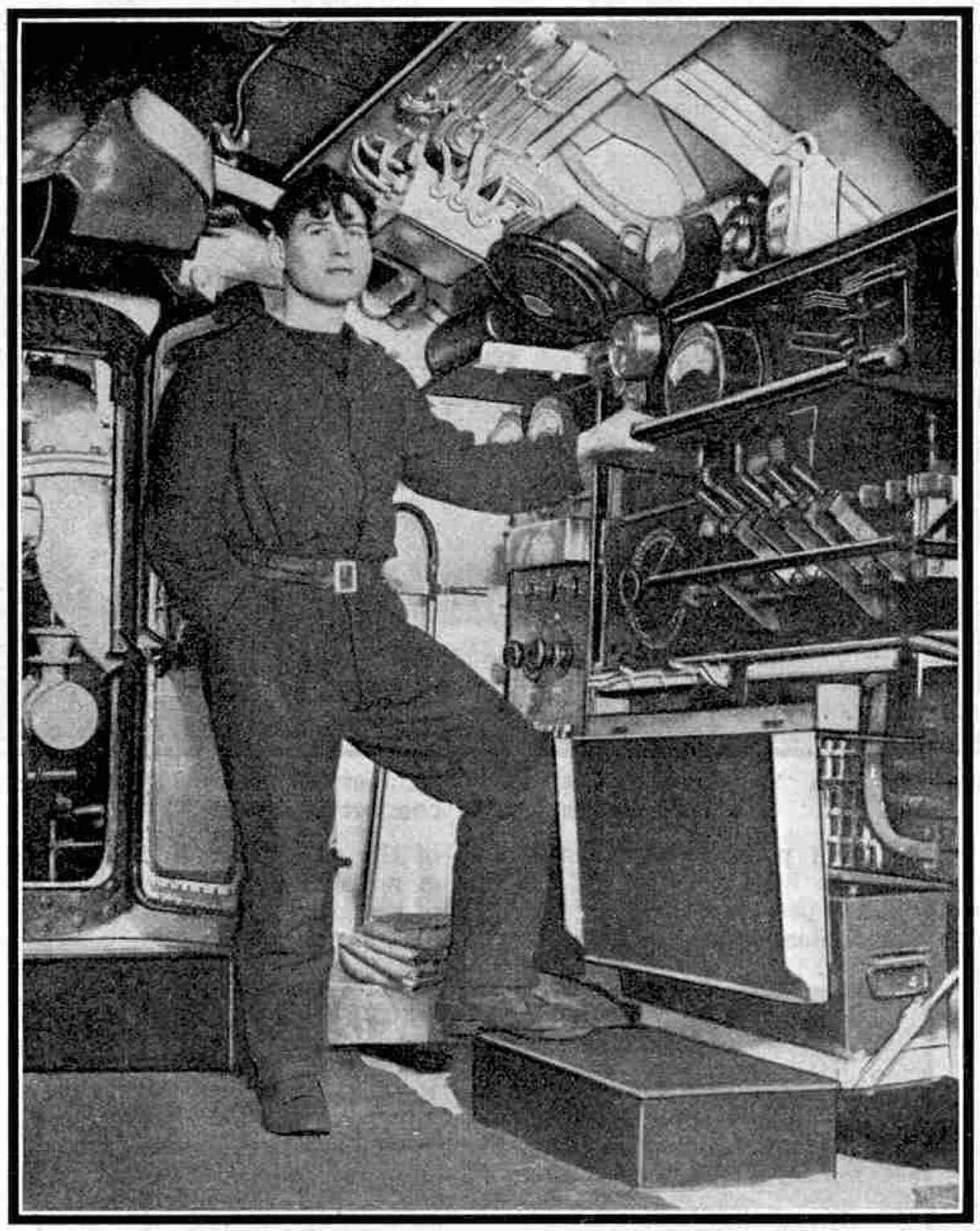
doned, therefore, as soon as a satisfactory type of internal combustion engine using less volatile fuel was found. This was the Diesel engine, introduced in the " E " class of British submarine. The Diesel engines of a modern British submarine develop a total of over 5,000 h.p. When they are in operation they are connected up to the dynamos and by this means the accumulators below deck are re-charged during their idle periods.

A modern submarine is either a twin-screw or triple-screw vessel and the Diesel engines are built up in two banks, one on each side of a narrow central gangway. The electric motors by which the submarine is driven when under water are situated in line with the surface propelling machinery and the propeller shafts. A modern submarine is capable of an under-water speed of roughly 11 knots.

Clutches mounted on the shafts enable the oil engines or the electric motors to impart motion to the propeller shafts either collectively or individually, while on the other hand both may be entirely disconnected from the propeller shafts when desired.

The engine room also contains the pumps necessary for emptying the ballast tanks, feeding the fuel oil to the Diesel engines, maintaining the supply of compressed air and regulating the ventilation. The accumulators that supply the current to the electric motors are accommodated beneath the floor of the engine room. They consist of hard rubber cells, placed inside large lead-lined tanks. Great care is taken in constructing these tanks in order to ensure that the lead lining is flawless, so that the acid contained in the cells may not find its way through any cracks and thus come into contact with the steel plating of the adjacent ballast or fuel tanks or the hull of the submarine.

The tanks that contain the heavy oil for the Diesel engines are situated beneath the floor of the main deck amidships. If supplementary fuel tanks are required they are placed in the double hull at the stern of the vessel. These tanks are at a slightly higher level than the main tanks, to which the oil is allowed to flow by gravitation when it is required.



The engine and control compartment of a submarine, giving a good view of the switchgear

Sufficient compressed pure air is carried in a modern submarine to sustain the crew for 24 hours. The exhaled air is drawn into a purifying apparatus in which potash absorbs the carbonic acid gas, after which the cleansed air is collected and re-oxygenated. It is then passed through radiators and cooled by sea water before being re-admitted into the submarine, and in this manner a cool healthy atmosphere is maintained on board. An additional supply of compressed air is also carried in cylinders stored in cellular compartments located in different parts of the double bottom of the vessel.

When submerged, a submarine is ventilated by means of electric fans, but when the vessel rises to the surface these are shut off and ventilators, situated in the roof of the hull and level with the outer deck, are opened. These ventilators are equipped with watertight covers.

The submarine is electrically lighted and heated. The heating is necessary for the comfort of the crew when the vessel remains submerged for any prolonged period, as the atmosphere inside then becomes very chilly. This is due to the low temperature of the surrounding water and to the fact that the electric motors do not diffuse any warmth as do the oil engines used during surface cruising. The coolness of the re-oxygenated air also plays its part.

The accommodation provided for the crew of a modern submarine is a great improvement upon the cramped and rough conditions that prevailed in the early vessels. There is no such thing as spare room even on a submarine of to-day, but the crew now have comfortable sleeping quarters and small saloons. In the early days of the submarine there were no facilities for preparing a hot meal, but in modern vessels electric cookers have made this an easy matter. One thing that is still lacking is adequate means of rendering sea water fit for drinking purposes, and ample supplies of drinking water still have to be carried.

The improvement in the conditions under which the crew of a submarine live and work has played a by no means unimportant part in the increase in the range of action of these vessels. Nevertheless, life in a submarine must inevitably be more nerve-racking than that in any surface vessel, especially during war-time when destruction by submarine, mines or depth charges may occur at any moment.

There can be no doubt that the submarine will develop still further, but in this direction the task of the engineer will be difficult. This is particularly the case in regard to speed, on account of the necessity for providing dual means of propulsion. Possibly a propelling system will be developed that will be equally efficient either afloat or when submerged.

Producing the " *M.M.* "—

(*Continued from page* 789)

with pen and ink, as other books are, to the end that every man may have them at once."

Later he returned to England and was permitted by the Abbot of Westminster to set up his press in a house situated on the south-west of Westminster Abbey. There he continued to be busily engaged in writing and printing until his death in 1491 or 1492. The place where the house stood was called the Almonry, as it had formerly been the scene of the distribution of alms to the poor by the Abbey authorities. It may be remarked that in its early stages the art of printing was closely connected with religious institutions, as it was in these that learning found its chief home.

It is interesting to note that Caxton's first work in England was the production of poems by Chaucer, Lydgate and other famous early English writers. Altogether Caxton printed over 100 works, including at least one—the " Metamorphoses " of Ovid—of which every copy has perished.

One curious episode in the history of printing in England illustrates the difficulty of deciding to whom the credit of inventions made long ago should be given. A book that undoubtedly was printed at Oxford bears on its title page the date 1468, which was nine years before Caxton began work in England. Some 200 years later a certain Richard Atkyns alleged that he had seen in the library at Lambeth Palace a manuscript in which it was stated that the book in question was printed by Frederick Corsellis, a Dutchman who had been invited to England by Henry VI. From this evidence it appeared that it was Corsellis and not Caxton who introduced printing into England. Nobody else has ever seen this manuscript, and it is now certain that the date in the book was accidentally printed 1468 instead of 1478. Atkyns made such good use of the interest created by his alleged discovery that he was granted valuable printing rights by Charles II. (*To be continued*)

The Story of the Motor Car

VIII.—Electrical Methods of Lighting and Starting

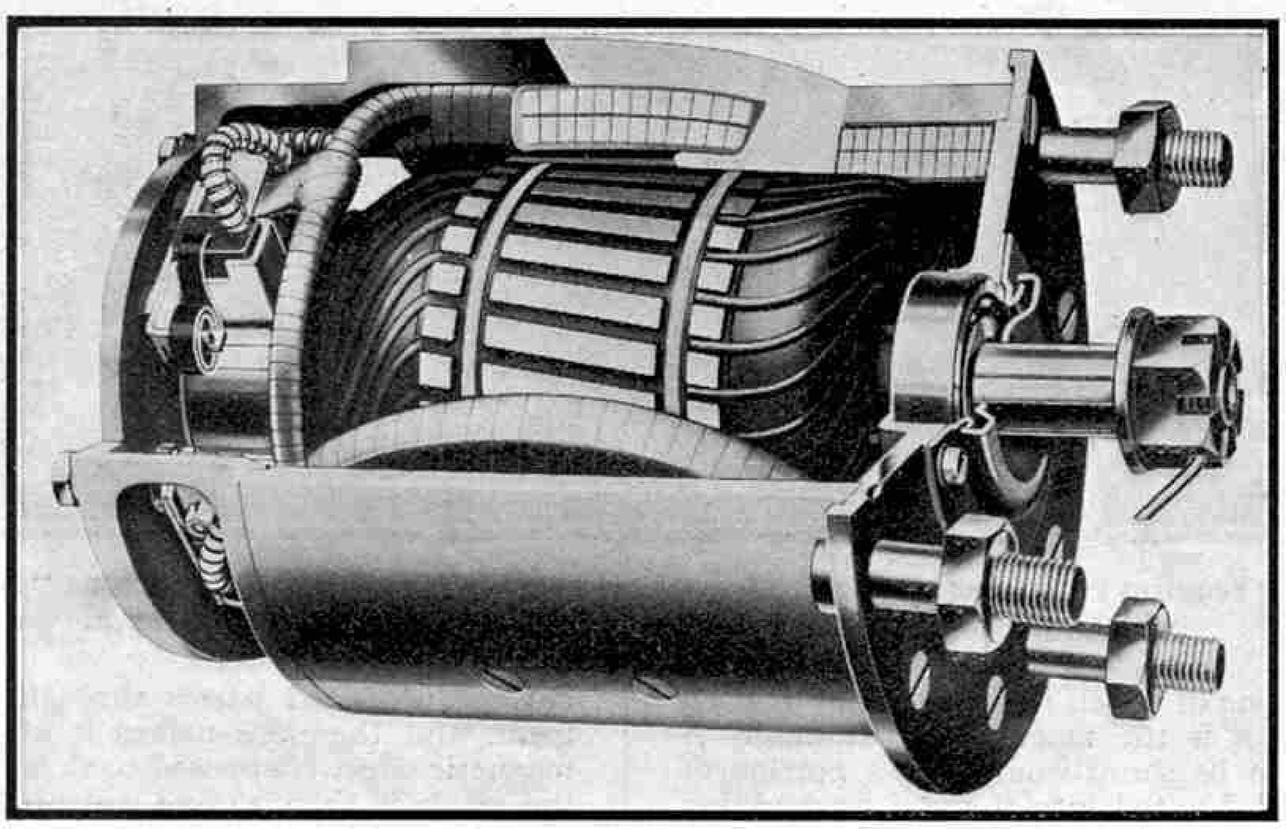
THE previous articles in this series have dealt with the construction of the motor car and the manner in which its various parts work. In order to complete the story it remains for us to describe the electrical arrangements that are a prominent feature of all modern motor cars. Electricity has been used for ignition purposes since the very early days of the motor car, but to-day it is also used for lighting the lamps of the vehicle, starting the engine, keeping the windscreen clear and blowing the horn. In addition, its application to its original task of ignition has been made more efficient. How electricity is used to-day for this purpose was fully explained in the June number of the "*M.M.*," on page 488 of which appeared an article dealing with the construction of the magneto. It was also explained that the introduction of new applications of electricity has resulted in a tendency to displace the magneto by a dynamo as a source of current.

The magneto itself is a dynamo, of course, but its output is severely restricted. The average magneto is only required to give a spark twice in each revolution and a simple winding in an H-shaped armature is therefore used. The current produced is proportional to the rate at which the lines of force are cut by the rotating coil, and thus the maximum current is only produced when the wires constituting the coil cut the lines of force at right-angles. At other times during the rotation very little current is produced.

When current is required for lighting purposes, fluctuations of this kind are obviously undesirable. This is the case even when an accumulator intervenes between the lamps and the generator, as the condition of an accumulator is best maintained when it is charged at a steady and uniform rate. The use of electricity produced on the car itself for lighting and other purposes thus makes it necessary to incorporate an efficient dynamo with a steady output. This in its turn makes the magneto practically superfluous, as it is possible to use current from the accumulator in conjunction with a coil and a distributor of the type described in the article on ignition.

The electrical outfit of a car comprises an engine-driven dynamo that is used to charge a storage battery. Wiring from the latter is taken through switches to the various lamps, a horn, and to the motor that is used to turn the engine in order to start it. If no magneto is used, other wires lead to the coil and distributor. A cut-out and fuse box are also fitted, while an ammeter, and very often a voltmeter also are incorporated to enable the performance of the various parts of the outfit to be checked. A reference to the diagram on this page will make the relationship of these parts quite clear.

Since the machine is required to charge an accumulator a continuous-current type of dynamo is always used. A dynamo of this kind in its simplest form consists of a coil of wire that is rotated between the poles of a magnet and forms the armature. The two ends are attached to the insulated halves of a copper ring. These rotate with the coil and in contact with them are the "brushes," or blocks made of hard carbon or copper, that serve to conduct the current away from the collecting rings.



Courtesy [*Joseph Lucas Ltd.*

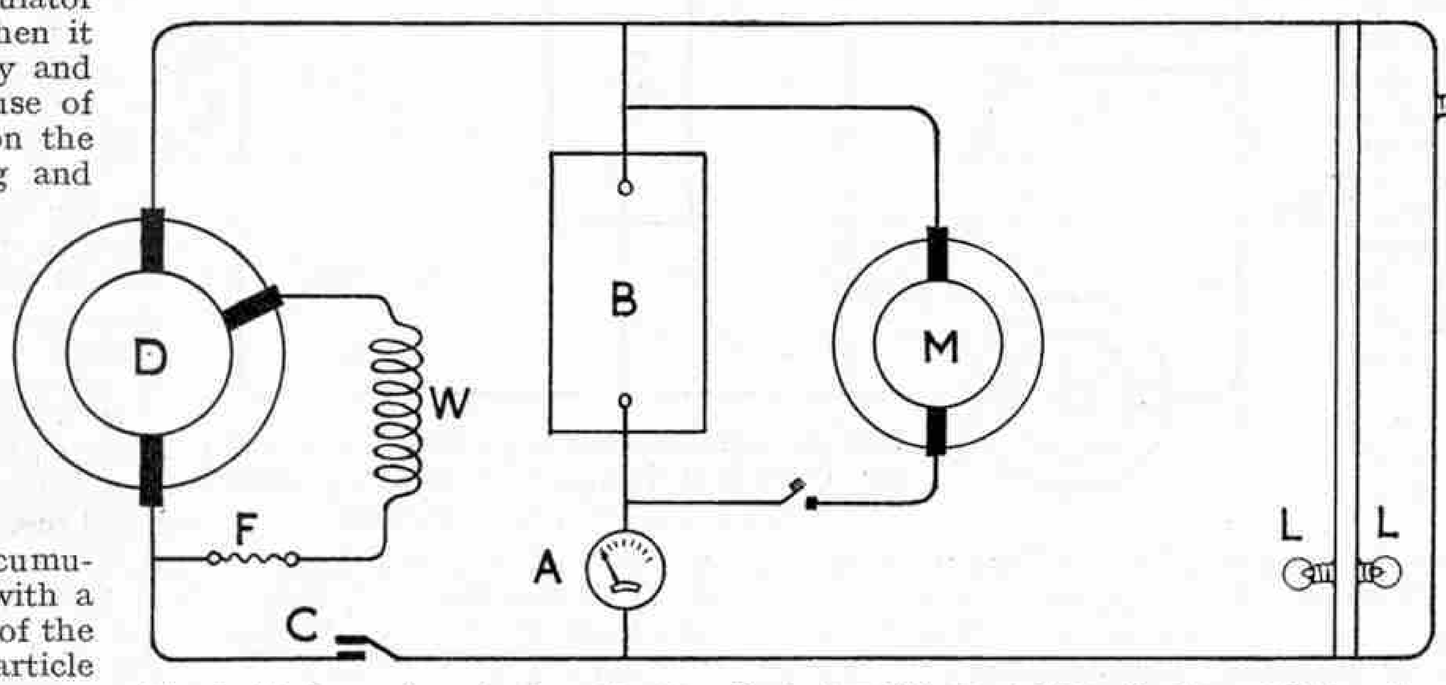
Sectional view of a dynamotor, a useful machine that serves the purpose of dynamo or starting motor as required. The bars of the commutator and a carbon brush held in position by a spring are clearly shown on the left

It will be seen that each brush remains on one half of the ring for half a revolution and then passes over to the other half. Thus during half a revolution the current is flowing from one brush in the direction of the accumulator. During the next half revolution the current will reverse its direction round the coil, as each half will now be traversed by the lines of force in the reverse direction. But the brush has passed over to the other half of the ring and the current will be therefore still leaving by it. Thus the output current will always flow in the same direction.

The two halves of the copper ring constitute what is known as a commutator and, as the above description shows, its purpose is to ensure that the output current is always in the same direction in spite of the change brought about by the rotation of the coil.

In practice the apparatus used is much more complex. If one coil only is used, as in the simple form of dynamo described, the current rises to a maximum when the wires are moving across the faces of the poles of the magnet and are cutting the lines of force between the two at right-angles, and falls to a minimum when they are running along the lines of force in the intermediate position. As already noted, this is the state of affairs met with in the case of the magneto. It is avoided by using several coils so arranged that the wires cut the lines of force at right-angles in turn and at equal time intervals. This ensures that maximum current is being produced in a proportion of the windings at all times, and this proportion is constant. Thus the maximum current passes through the wiring to the storage battery, not twice in each revolution of the armature, but many times, and by using a sufficient number of coils a current is obtained that may be regarded as being practically continuous and constant.

Additional assistance in preventing the occurrence of "peaks" in the induced current is provided by using more than one pair of magnetic poles and thus providing more positions in which lines



The electrical arrangements of a motor car. The battery B is charged from the dynamo D through the cut-out C, and the fuse F is placed in the magnetising winding W. Charging current is registered on the ammeter A. M is the starting motor

of magnetic force are concentrated in the path of the windings.

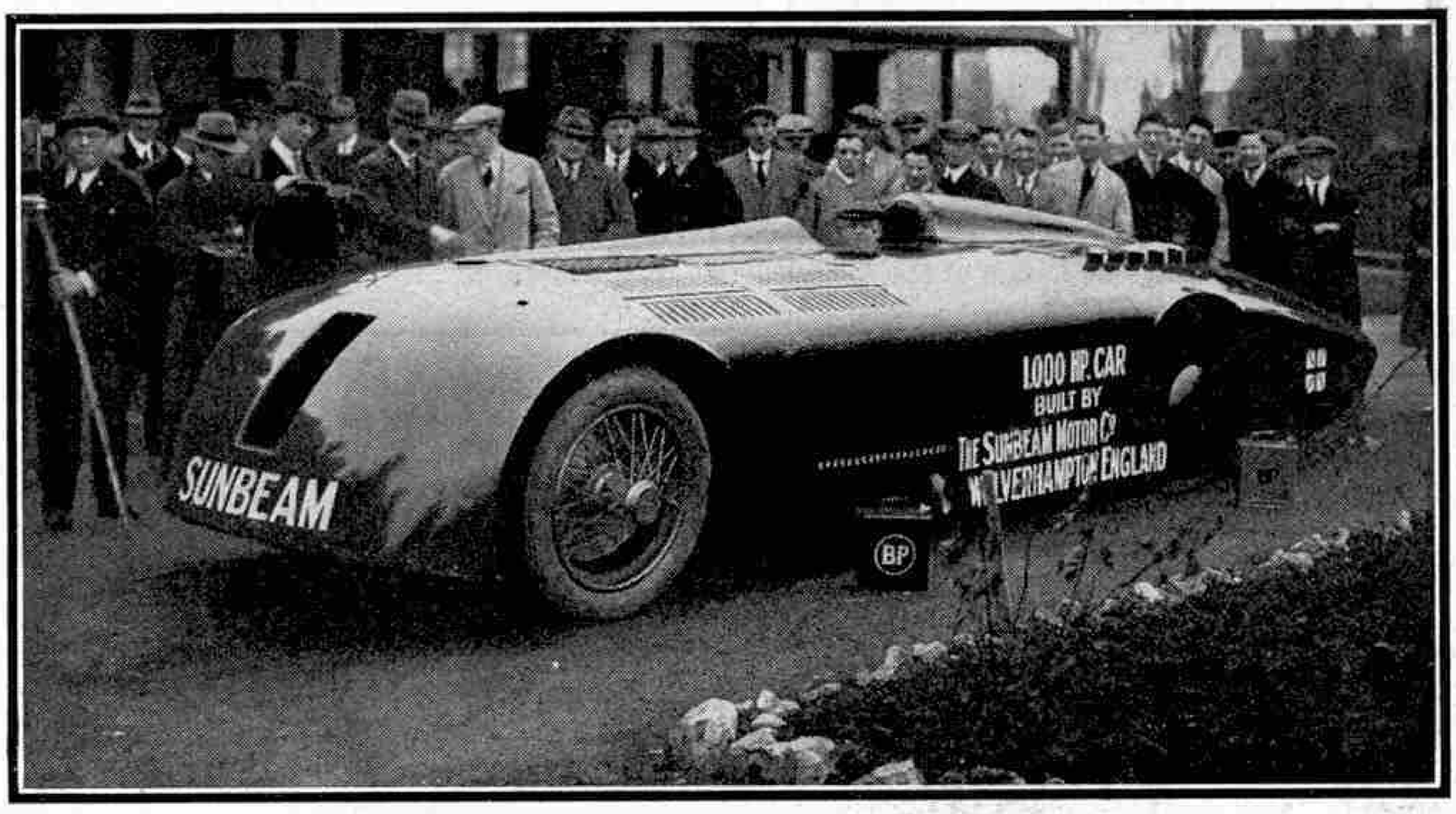
The commutator is correspondingly more complicated. Instead of consisting of two halves of a ring it is made up of a large number of segments, the ends of each coil on the armature being led to a pair of segments at the ends of a diameter. The segments are really bars of hard-drawn copper arranged in a circle, and insulated from the shaft by a mica bush. Strips of the same insulating material separate the segments. The brushes are blocks of hard gas carbon, the ends of which are ground to fit on the surface of the commutator. They are usually made large enough to be in contact with two adjoining segments in order to reduce sparking.

The magnets used in a dynamo of this kind are electro-magnets and the current required for them is supplied from the dynamo itself, which is thus of the type known as self-exciting. There are three ways in which this current may be used. In what is known as a series-wound dynamo the whole of the excited current flows through the magnetising coils, the wiring of which is continuous with the external circuit. In other dynamos the current is divided between two parallel circuits, one of which is the external lighting or power circuit, and the other is the magnetising winding. A dynamo of this kind is said to be shunt-wound, as a portion of the current that it produces is shunted into the coil surrounding the magnet, a portion only being available for external use.

A dynamo is often required to give an output of constant voltage under all circumstances. How this is effected may best be understood by considering what happens in the cases of the types of dynamo already referred to when the resistance in the external circuit decreases and the current increases correspondingly. In the case of the series-wound dynamo, this results in an increase in the current passing through the magnetising windings. The magnetic field is intensified and the voltage across the terminals of the dynamo becomes greater. In the case of a shunt-wound dynamo the effect is exactly the opposite. When the resistance in one of two parallel circuits falls, a greater proportion of the current is diverted to pass through it. In the case considered the current in the shunt windings is reduced and the magnetic effect and also the voltage across the dynamo terminals are thus decreased in consequence.

When output of constant voltage is required, a dynamo combining these characteristics is used. The magnets are excited by two coils, one of thick and the other of thin wire. The thick wire coil is connected in series with the output of the dynamo, while the thin coil is connected in parallel. The opposite effects on the two windings of changes in the external circuit are thus neutralised. Thick wire is used for the series winding in order to offer as little resistance as possible to the current that also passes through the main circuit. A dynamo of this type is usually described as compound.

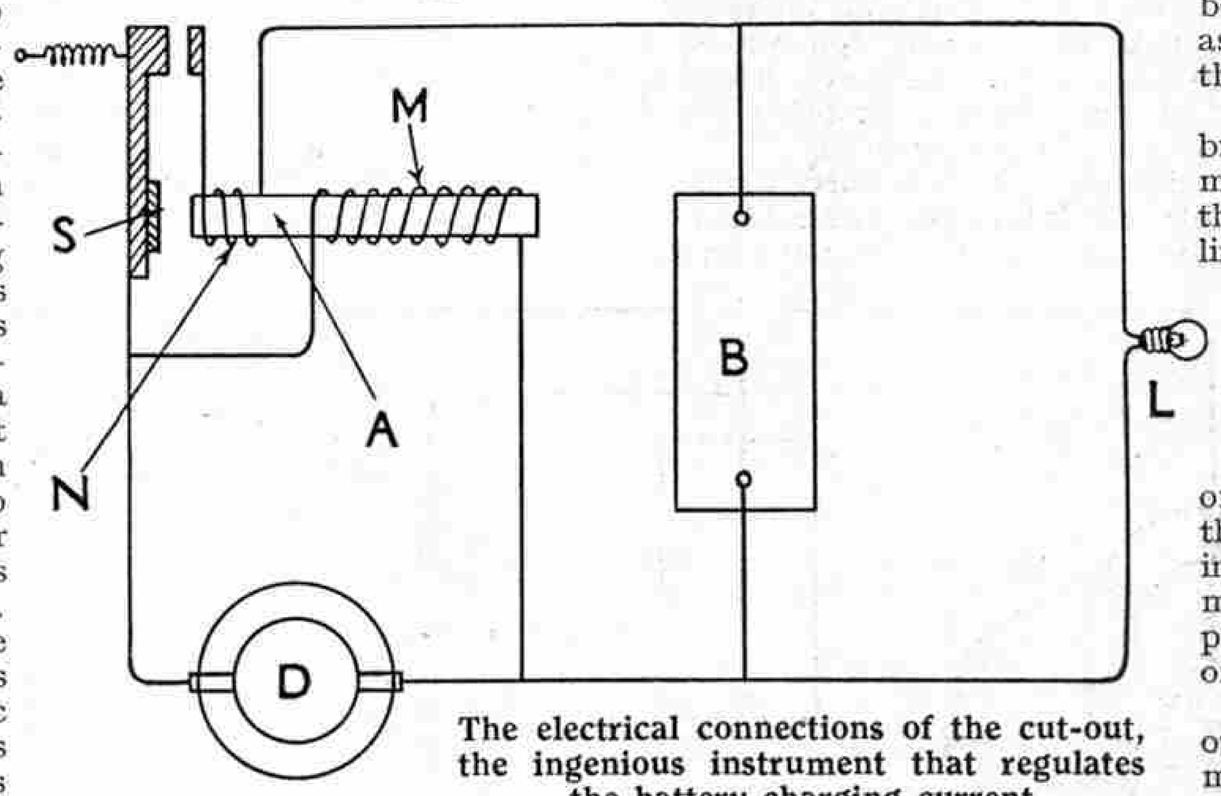
Dynamos intended for use on a motor car are not compound wound, but shunt-wound, and a very ingenious method of controlling the voltage across their terminals has been very largely adopted. It is known as the third brush method, because it involves the use of an additional carbon brush of the same type as those used to collect current from the commutator. In an ordinary shunt-wound machine the ends of the shunt winding are connected to the collecting brushes. When the third brush method of control is used, one end of the shunt winding is connected to a third brush that is in contact with the commutator at a point between the positions of the collecting brushes. Thus the full voltage developed by the dynamo is not applied to the production of the magnetic field and any proportion may be so used.



A car that requires eight magnetos and 48 sparking plugs ! Major Segrave's famous " Sunbeam," which was the first car to attain a speed of more than 200 m.p.h.

The actual position of the third brush is very important. In dealing with the simple form of shunt-wound dynamo it was assumed that the lines of force stretched from one pole to the other by the shortest path. If this were the case, and the third brush were placed half-way between the collecting brushes, it would be in a very weak portion of the field.

Fortunately for control methods the lines of magnetic force do not pass by the shortest line from one pole to the other. It must be remembered that the current produced passes through the windings of the armature itself, and therefore makes it also into an electro-magnet. Its magnetic effect is opposed to that of the main electro magnet, and the result is that, as one end of the armature moves away from one of the poles of the electro-magnet, it tends to drag the lines of force after it. If the iron filings method could be used to trace the direction of the lines of force, it would be seen that a twist is thus imparted to the magnetic field and the amount of twist becomes greater in proportion as the speed of rotation of the armature increases.



The electrical connections of the cut-out, the ingenious instrument that regulates the battery-charging current

As already stated, the third brush is placed between the main brushes. As the speed of the armature increases and the lines of force are pulled further round, the coils on the armature that supply the field-producing current may be brought automatically into a weaker part of the field by a proper distribution of the brushes. The current through the magnetising windings is thus decreased, and the magnetic effect reduced, to compensate for the increased speed of rotation.

It may be noted that the output of an electrical generator may be increased by advancing the brushes in the direction of rotation of the armature. When this is done they follow the twist of the magnetic field into a part where the lines of force are most numerous. Similarly the output may be reduced by moving the brushes in the opposite direction.

The third brush system does not, by its action, keep the voltage across the terminals of a dynamo absolutely constant, but in conjunction with the accumulator it is sufficiently effective. The voltage of an accumulator that is kept in condition varies only slightly, and as the battery used in a car lighting system is connected in parallel with the dynamo it helps to steady the current. Any excess over that required for the lamps or for any other purpose is simply absorbed by the accumulator.

In addition to this protection a fuse is provided to guard against

the possibility of the accumulator leads coming adrift. If this should happen the current from the generator would proceed directly to the lamps and possibly burn them out, and a fuse is therefore placed in the shunt winding. Any excessive current immediately burns out the fuse and destroys the magnetic field on which the production of current depends.

When a car is running very slowly the speed of revolution of the armature may not be sufficient to produce a voltage that will overcome that of the battery. If the charging switch were on under these circumstances the higher voltage of the battery would cause current to flow from it through the dynamo in the reverse direction. To guard against this loss a cut-out is placed in circuit with the battery and the dynamo.

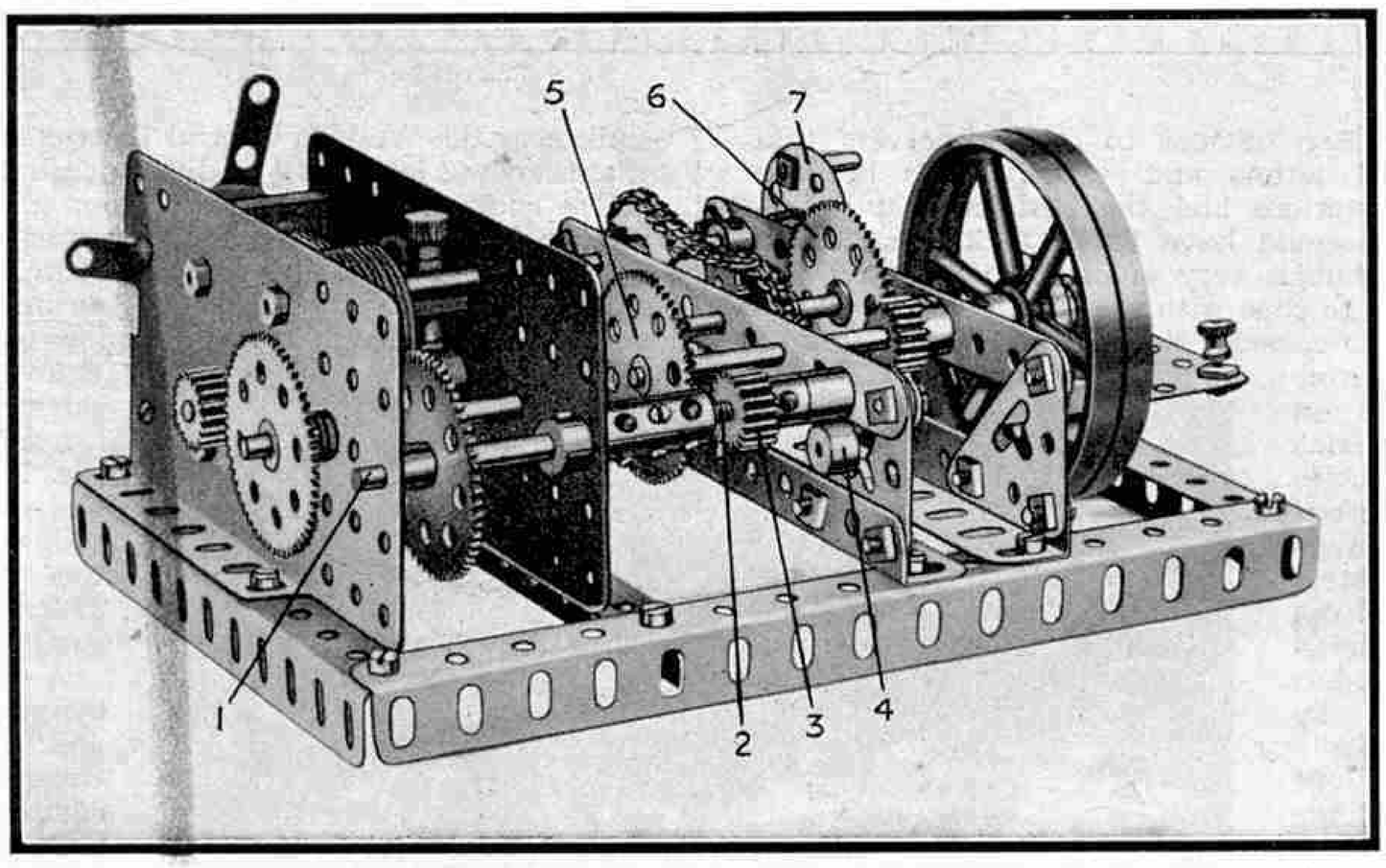
The chief features of a cut-out are shown in the diagram on page 810. A is a soft iron core round which are two coils M and N. M is a shunt coil from the dynamo. When the latter produces current at a voltage sufficient to overcome that of the battery, the magnetic effect induced by this coil suffices to attract towards the end of A a soft iron block S that is attached to one member of a switch. This closes the switch and brings the battery into circuit with the dynamo. A spring is used on the attracted switch member in order to prevent contact being made by weak currents from the dynamo.

When the speed of the dynamo falls so low that reverse current from the battery may flow, this passes through the second coil N, where it produces a magnetic effect that is opposed to that of the coil M. The attracting power of the core A is thus reduced and the spring pulls open the switch.

The dynamo is mounted alongside the engine and geared to the crankshaft or driven from it by a whittle belt. Leads from it go through the cut-out to the storage battery and the ammeter on the switchboard is included in this circuit in order that the current being supplied may be tested. Variations from normal current indicate faults in the circuits, and the general performance and condition of the entire electrical outfit may be judged by keeping a close watch on the ammeter readings. As a rule an instrument with a central zero is used. This indicates the direction of the current as well as its magnitude, the needle being deflected to one side of its central position when the battery is being charged, and to the other when discharge is taking place. Obviously a reversal of the direction of the current involves a reversal in the direction of the magnetic field that causes the needle of the ammeter to move from zero position.

The battery is a very important part of the electrical outfit of a car as the efficiency of the whole is largely dependent on its condition and capacity for work. Unfortunately it is usually well hidden, while defects develop slowly and do not show up as quickly as those of a mechanical character. Accordingly, prevention of trouble rather than its cure must be the chief aim. The demands made must be strictly limited to those for which the battery is designed. It must also be kept well charged and a hydrometer or battery tester used at frequent intervals to ensure that the density of the acid is being maintained at the correct figure.

The ammeter readings not only show when and how the greatest demands are made on the battery, but also they indicate whether charging is being properly carried out. It is almost as important to use a steady charging rate as it is to discharge a battery steadily.



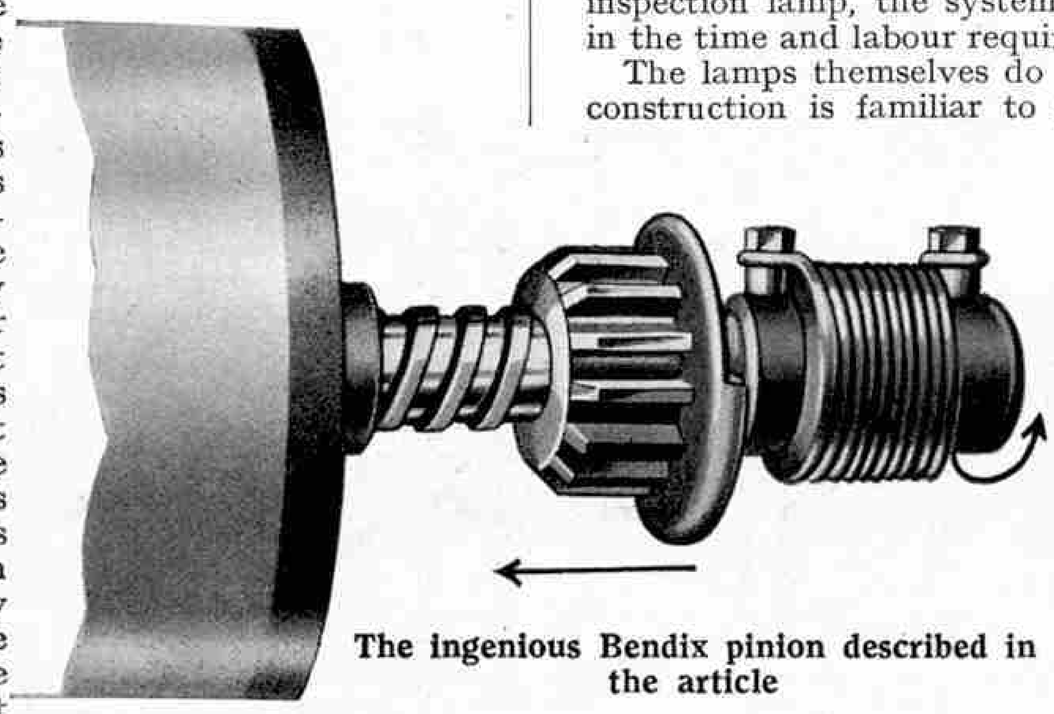
The Bendix pinion reproduced in Meccano

When the charging current is produced by a machine whose speed varies, an ideal constant current cannot be attained in practice, but a sufficiently near approach may be made with the aid of a cut-out and the three-brush system of control already described. Careful observation of the ammeter readings will show if this condition is attained in practice.

When the generator of a certain car, for instance, was tested, it was found that it " cut in," or began charging, when the engine speed reached 300 revs. per minute. As the speed increased the current produced increased very rapidly from 1½ amps. at 300 revs. per minute to 13 amps. at 800 revs. per minute, and it remained practically constant at this value as the speed increased still further. Expressed in terms of road speed, the charging current reached its full value at 15 to 17 miles per hour and remained at 13 amps. even when the speed increased to more than 40 miles per hour. Thus in normal circumstances the battery received an even charge and any variation from the usual charging current shown by the ammeter indicated that the driving belt required tightening, the connections were in need of renewal, or that the dynamo brushes needed adjustment.

From the battery parallel circuits lead to the starting motor, the lamps, the horn, and the windscreen wiper, if this is of the type that is turned by a small electrical motor. These are controlled by switches that are grouped together on a board placed in a convenient position within reach of the driver. In earlier types separate switches were provided for each lamp, but it is now more usual to group the leads in such a manner that one switch operates both side lamps and the red rear lamp, while another controls the combination of head lamps and rear lamps. As five lamps are usually fitted, exclusive of dimming devices and an inspection lamp, the system of grouping leads to a great saving in the time and labour required for switching them on.

The lamps themselves do not call for much comment, as their construction is familiar to practically everybody. Head lamps offer most variety. Some of the bulbs used in them have two wires, one of which gives a much feebler light than the other. The dim light is used when meeting approaching traffic, as the dazzling effect produced by looking into the powerful beams of a pair of modern electric lamps may lead to dangerous situations and even to serious accidents. The fitting of head lamps that may be dimmed is only a palliative, however, and the tendency to-day is to use lamps that allow the light from them to be focussed into a comparatively narrow beam of light, or to use reflectors and shields that produce a similar effect. One very interesting method of dodging the difficulty is to use lamps that may be tilted forward in order to direct the beam of light from them downward on the approach of another vehicle.



The ingenious Bendix pinion described in the article

The starting motor is usually of the series wound type. It is geared to run at 10 or 12 times the speed of the crankshaft and turns the latter at 80 to 150 revs. per minute, a speed that is quite sufficient to give easy starting even with magneto ignition, when the strength of the spark depends on the speed of the engine.

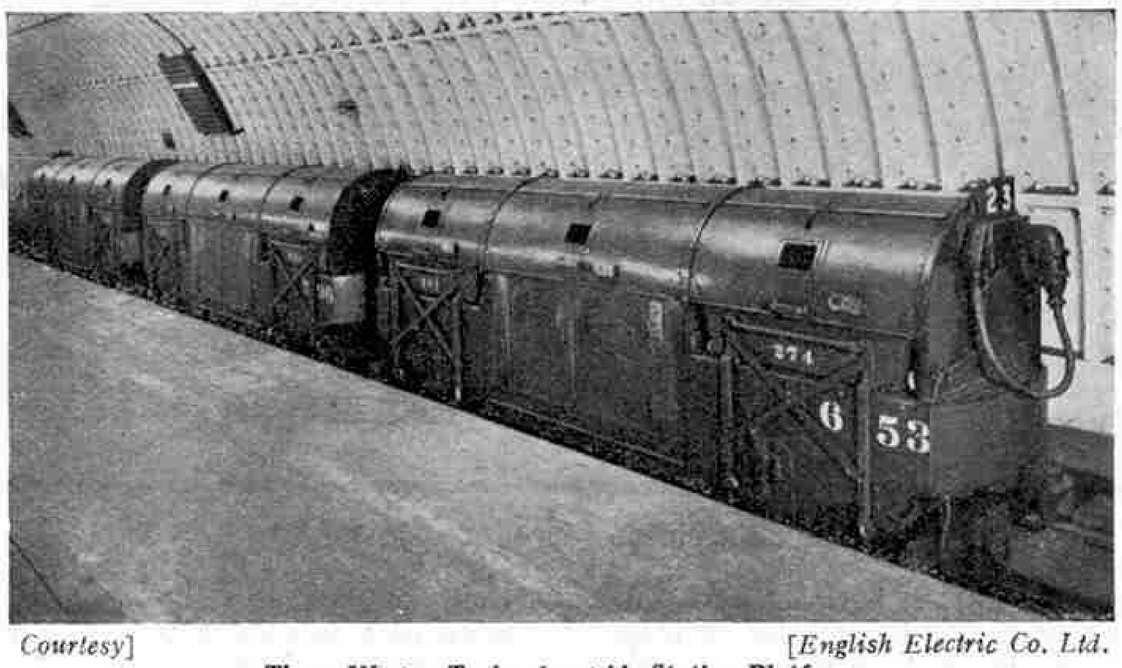
Some difficulty may be experienced in turning an engine that is stiff or when the oil in the bearings is congealed. Normally the current required on bringing a starting motor into operation is from 150 to 200 amps. but in the case of a gummy engine this may be as high as 300 amps. This rush is very hard on the batteries and they should be protected by freeing the engine by hand if necessary, and by giving the starting

Continued on page 825

London's Post Office Tube Railway

A Triumph of Automatic Mechanism

FOR many years it has been obvious to close observers that the transportation of letters and parcel mails between the London railway stations and the District Post Offices presented a problem that would have to be tackled seriously. The road van service, although very efficient in its way, was becoming less and less able to cope with the traffic, and in 1909 a committee was appointed to consider the question of providing a substitute. The committee made exhaustive inquiries on the Continent and in America with regard to the advantages and disadvantages of the various pneumatic tubes and railways then in existence and ultimately came to the conclusion that the best solution of the London problem would be an underground railway operated by electricity. In due course a detailed scheme was worked out and the construction of the railway was commenced in 1913. In October of the following year tunnelling was commenced, but the War brought work to a standstill. After the War the work was renewed, but it was repeatedly and seriously delayed by various difficulties, among which was the serious one of abnormally high prices. The railway was finally completed and put into operation in December of last year.



Courtesy] [*English Electric Co. Ltd.*

Three-Wagon Train alongside Station Platform

The total length of the railway is at present 6½ miles. The line runs from the Eastern District post office at Whitechapel to the Paddington District post office, adjoining Paddington Station, with intermediate stations at Liverpool Street station, the King Edward Building post office in Newgate Street, Mount Pleasant post office, Western Central District post office in New Oxford Street, and the Western District post and parcel post offices in Wimpole Street.

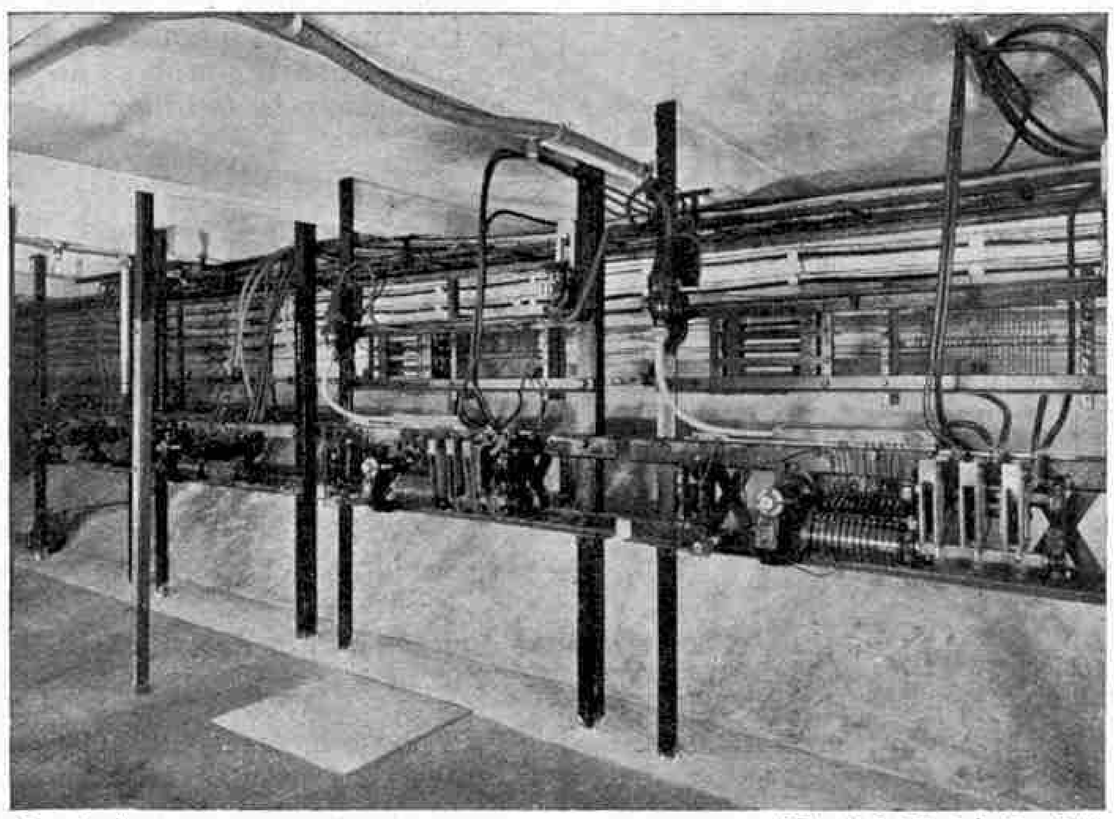
The entire railway, including a car depot at Mount Pleasant, is below ground, and the whole of the material required for carrying out the work had to be lowered down shafts, seven of which were sunk at various points along the route. The debris excavated during the boring of the tunnels also had to be removed by this means. The contour of the locality rendered it necessary to sink the shafts to various different depths. The shaft excavated near the Western parcels office, for instance, was carried to a depth of 72 ft. below the road surface, while that sunk near the Western Central District office was 65 ft. in depth. Some of the shafts were sunk on temporary working sites obtained by the Postmaster General. The shaft excavated at the western end of Finsbury Circus was partly in a public garden and partly in the roadway, while one excavated at the King Edward building in Newgate Street was sunk in a yard close to the site of the old Roman wall.

The boring of the tunnels was commenced from the base of the shafts, and in some cases was carried in both directions. The accuracy with which this work was done was shown when the tunnel party boring westward from one of two shafts sunk at Mount Pleasant met the party excavating eastward from the shaft sunk near the Western Central District office. It was then found that there was less than ⅛ in. difference in the level of the two borings.

The short tunnels that form the stations were driven by hand-mining, but the long ones between stations, with the exception of one at Mount Pleasant, were excavated by means of Greathead shields. The Greathead shield is an improvement upon a tunnel shield that was invented by the famous engineer Sir Marc Isambard Brunel. This improved type of shield was first used in 1869 for a subway 7 ft. in diam. at the Tower of London, but the first undertaking of any magnitude carried out by means of it was the Blackwall Tunnel, 27 ft. in diam. which was completed in 1897.

A Greathead shield is a huge cylinder built up of steel plates and divided by upright and transverse partitions into several compartments. The shield is built to the diameter of the tunnel and pressed flat against the material to be cut away, and the task of excavation is carried on simultaneously in all the compartments by workmen with pick and shovel. Compressed air is maintained in the compartments at a total pressure of from 150 to 200 tons, which is sufficient to prevent any inrush of water, while it also keeps back the loose earth.

The rim of the shield presented to the earth face is bordered with knives and, as the shield is pushed forward horizontally by powerful hydraulic rams at the rear, the knives forming the cutting edge are driven into the unbroken earth. The material projected into the compartments is removed by the workmen and loaded into small trucks that are passed through air-locks to the nearest shaft, where they are conveyed by lift to the surface. As the shield is pushed forward the excavated tunnel face behind the machine is coated thickly with liquid cement or "grouting," after which another ring of iron lining to the tunnel is built into place.



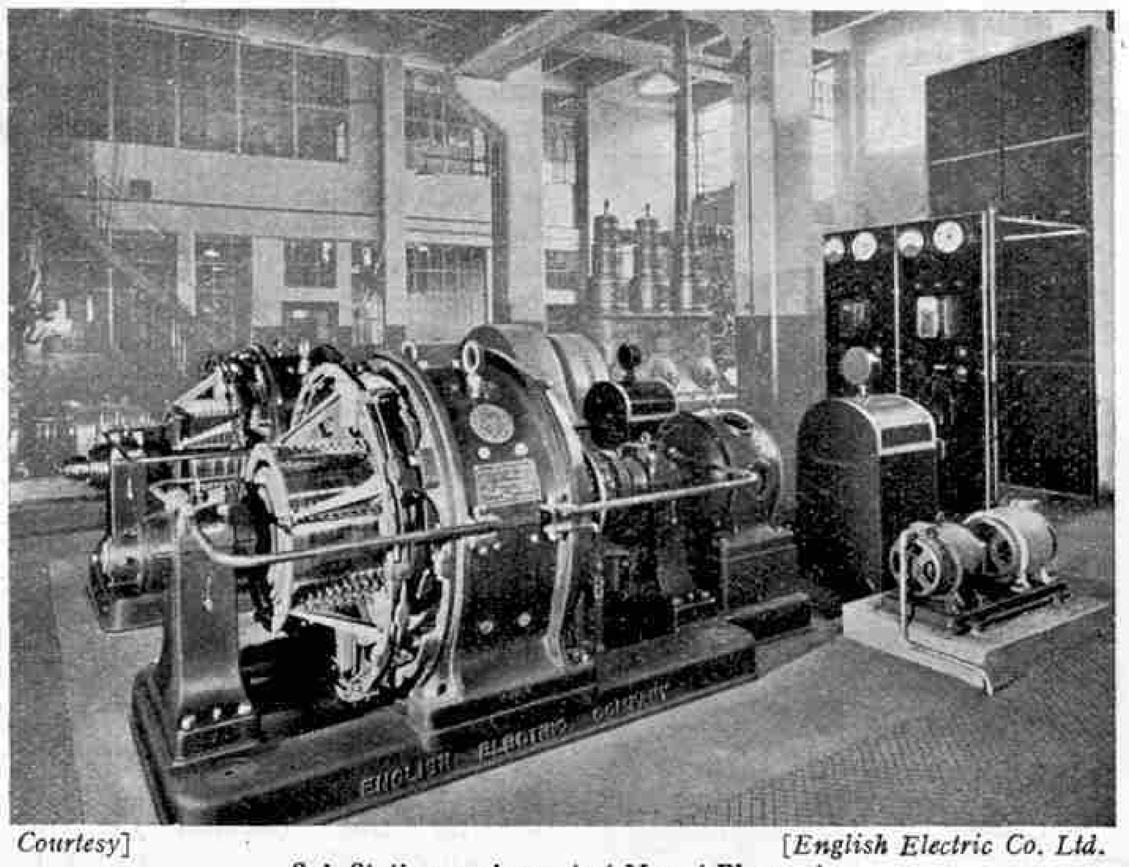
Courtesy] [*English Electric Co. Ltd.*

A Station Group of Camshaft Controllers

The workmen enter or leave the compressed air compartments by way of chambers known as "air-locks," in which the amount of air pressure is gradually increased or decreased in order that the men are not subjected to any violent change of pressure. The conditions are similar to those existing in a caisson used in bridge-building, in which a workman going off duty has to remain in the air-lock while the pressure is gradually reduced and the excess of nitrogen, absorbed by the blood during the time he has been working in compressed air, is gradually expelled by the lungs.

The gauge decided upon for the tube railway was 2 ft. and between stations there are two tracks, one for east-bound and the other for west-bound traffic. In order to reduce the cost of constructing the line both tracks have been placed in a single tunnel 9 ft. in diameter and running at a maximum from the surface of between 70 ft. and 80 ft. The station platforms are of the "island" type similar to those on the ordinary tube railways, and at a short distance from the end of each station tunnel the 9 ft. tunnel opens out into two 7 ft. tunnels.

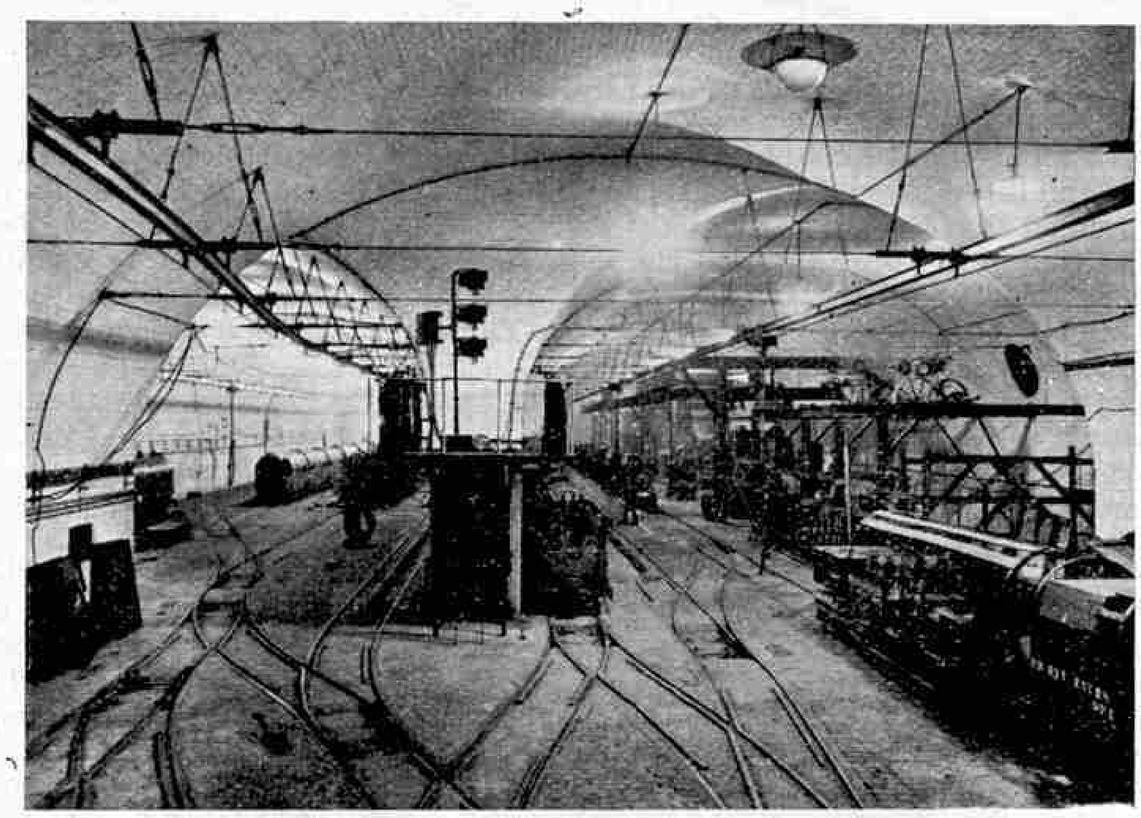
Each station consists of an island platform arranged in two sections, between which are situated a control cabin and the various lifts and conveying apparatus. In each case provision is made for a "through" line in addition to the platform line, and at the West Central District office, Mount Pleasant, and King Edward Building stations, a running-round loop line also has been laid down. At these three stations the inside diameter of the tunnel is 25 ft. as compared with 21 ft. 2½ in. at the remaining stations.



Courtesy] [*English Electric Co. Ltd.*

Sub-Station equipment at Mount Pleasant

The running rails are of British Standard Section No. 35, weighing 35 lb. per yd., and are mounted upon oak sleepers 3 ft. 6 in. in length, embedded in the concrete of the tunnel invert. On the running-round loops already mentioned the rails have a minimum radius of curvature of 60 ft., but on the stretches of track between the stations more generous curves have been possible and here the lowest radius of curvature is 400 ft.



Courtesy] [*English Electric Co. Ltd.*

General view of Mount Pleasant Car Depot, showing Track Arrangement

The electrical equipment of the railway, for which the English Electric Co. Ltd., are mainly responsible, is of outstanding interest. Power is fed to the trains by track transmission. The third or conductor rail is of the channel type, weighing 15 lb. per yd., and is supported on porcelain insulators spaced 9 ft. apart. It is located in the centre of the track and is elevated 3 in. above the face of the track level. Each joint is double-bonded by flexible bonds with solid terminals, and the ends of each length of rail are anchored to the sleepers as a precaution against "creeping."

The successive lengths of conductor rail are joined together by means of steel fishplates 1 ft. in length, ¾ in. in thickness and tapering in width from 1¾ in. at the base to ⅞ in. at the top. Where a break occurs in the continuity of the conductor rail, the rail is bent downward 1½ in. in a length of 1½ ft. to form a ramp, and the gap in the circuit caused by this break is bridged by means of a 0.1 sq. in. jumper cable, so fitted as to prevent all live metal from coming into contact with the running rails or the track foundations.

The conductor rail is divided into sections insulated from each other, and one running rail of each track is similarly divided. For sectionalising the conductor rail a 10 in. fibre block spacing piece is inserted between the ends and held in place by long fibre fishplates. In order to provide ample braking distance at the platform sections, and to ensure the trains halting at the right moment, the conductor rails in these sections have a lead of 2 ft. 6 in. over the running rails. The supply to each section of conductor rail is obtained through an electro-magnetic contactor, and the operating coil of each contactor is controlled jointly by automatic relays and the operator's signal lever desk in each station.

Each stretch of track between adjacent stations is divided into three running sections and one braking section, and the control of these sections is entirely automatic. The station lines are divided up into sections, the number of which depends on local circumstances and the number of berths at the station platforms. Movement of trains in the station sections is semi-automatic, being controlled by the station operator, but under automatic safety control. The system employed is known as the Ferreira-Insell Route Lever System.

The railway does not possess its own power station but obtains its requirements of electricity from the Charing Cross and City Electric and the City of London Electric Lighting companies. The supply mains of both companies are led to a special sub-station close by the Post Office sub-station at King Edward Building post office. Alternating current at a pressure of 11,000 volts is delivered through these mains to the special sub-station, where it is immediately stepped-down to 6,600 volts by a series of transformers. At this voltage it is distributed to three traction sub-stations situated at Mount Pleasant, Paddington and Liverpool Street respectively, and converted to direct current at 440 volts. The sub-stations are equipped by the English Electric Co. Ltd.

Alternatively power is obtained from one or the other of the companies for periods of not less than one month, and to enable the change-over from one company's mains to the other to be made at the prescribed times, or at short notice in the case of a breakdown, change-over switchgear is provided, and the 6,600-volt side of the bank of transformers is connected to duplicate bus-bars.

Generally speaking, the sections of conductor rail in the tunnels are energised at 440 volts and those in the stations at 150 volts. For furnishing the 150-volt supply, every station is provided with two motor-generators fed from the 440-volt mains. The supply from the 150-volt switchboard bus-bars is taken to a contactor rack and is there connected to the 150-volt contactors. Various auxiliary services in each station are also supplied from the 440-volt supply, and these are controlled from switchboards situated in the sub-station.

The rolling stock consists of 90 steel motor wagons, generally made up into 30 trains of three wagons each, the wagons being connected together by means of lengths of train cable, at each end of which is a twin coupling. A locking device prevents any of the couplings in use from working loose after a train has been made up.

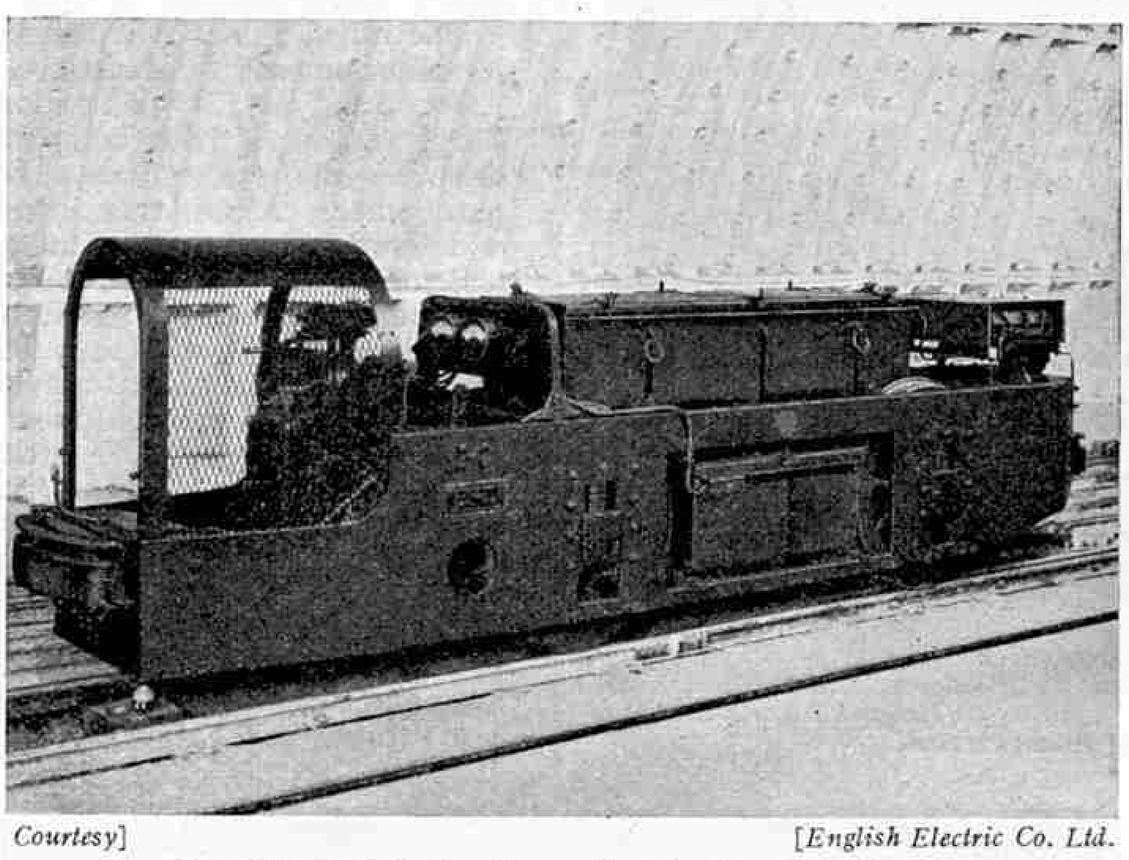
The wagons are of special design and have a carrying capacity of 1,120 lb. each. They are 13 ft. 6 in. in length over buffers and 12 ft. over the body, and they stand 4 ft. 11½ in. above rail level and are 3 ft. 6 in. in width over axle boxes. They have a wheel base of 7 ft. 3 in., while each wheel is 2 ft. in diameter over the tyre.

Courtesy] [*English Electric Co. Ltd.*

The Control Lever Desk in the Operator's Cabin at Mount Pleasant

Each wagon has two "English Electric" 22 h.p. motors giving a running speed of 30 m.p.h. on the level, and driven through single-reduction spur gearing enclosed in an aluminium case. Current is picked up by two collector shoes on each wagon. Each shoe is 7¾ in. in length, 3 in. in width and ¼ in. in thickness, and is capable of collecting 150 amps. The shoes are connected through resistances to a bus-line cable running from end to end of the wagon and terminating at a plug and coupler at each end, so that in a three-car train there is a bus-line fed from six collector shoes. Each motor is fed direct from the bus-line.

The two motors of each wagon have their field coil terminals brought to a hand-operated reverser. The brake blocks on each wheel are lined with Ferodo-bonded asbestos inserts, and are applied by means of a nest of springs, counteracted by a powerful solenoid connected in series with the traction motors. Hence the brakes are held off the wheels whenever current is passing through the motors, and are applied on a current failure or when the train reaches a dead section. Means have to be provided for moving the wagons in cases of emergency even when there is no current in the solenoid, and therefore the brakes can be screwed off the wheels by means of a hand-wheel situated at the same end of the wagon as the reverser and interlocked with it. This interlock is mechanical, and is so arranged that the brake can only be screwed off when the reverser is in the "off" position, and the reverser can only be set to "forward" or "reverse" when the brakes are free to operate automatically.



Courtesy] [*English Electric Co. Ltd.*

One of the three Battery Locomotives for Emergency Service

The body of each wagon is partitioned into three compartments, the centre portion having its floor approximately level with the station platform, while the two end portions are of such dimensions as to house beneath them the motors and electrical equipment. Each compartment accommodates a container, or small truck on castors, and is enclosed by semi-circular covers, the centre compartment retaining in position side flaps that can be lowered to form a runway up which the container, loaded with mail, is wheeled by hand.

The centre container is 4 ft. 4 in. in length, 2 ft. 6½ in. in width and 3 ft. 1½ in. in height at the ends, and is of 850 lb. carrying capacity. The floor consists of two three-ply wood doors attached to the framework by spring loaded hinges. These doors are secured in the horizontal position by means of a hand-operated locking mechanism and can be opened to discharge the compartment's load of mail through openings in the station platform. The doors automatically return to the closed position immediately the load is dropped out.

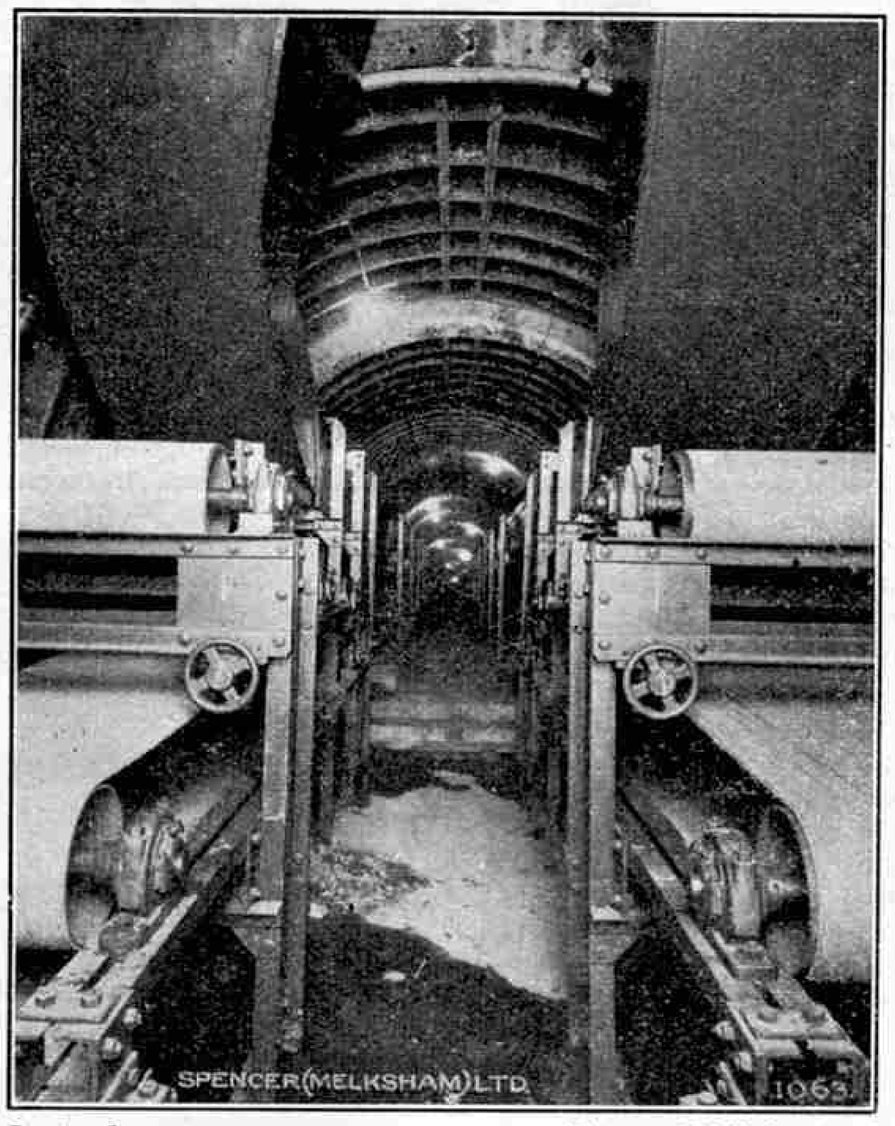
The two side containers are of only 300 lb. capacity and are of different construction; the side of the wagon cannot be lowered for them as for the centre container. They are constructed of steel sheeting and when on the platform are each supported by four legs about 1 ft. in length. The legs of each container are so attached that the front pair can be unlocked and swung up underneath when the container is pushed into the compartment.

Three battery locomotives are provided for use in case of emergency. They are 16 ft. 6 in. in length, 3 ft. 5 in. in width, and 4 ft. 11 in. in height, and have a working weight of seven tons. On test these locomotives were capable of starting six loaded wagons, equivalent to 18 tons, on a 1 in 20 grade, and in service they have hauled up to 54 tons—equivalent to six loaded trains—at 16 m.p.h. The electrical equipment consists of two 25 h.p., 350-volt totally enclosed motors, and the battery consists of 163 cells in two removable containers, and is rated at 84 ampere-hours at a five-hour rate of discharge.

The trains have to be brought down from a high speed in the tunnels to a speed of about seven miles per hour on the receiving section at the station approaches. In order to reduce the speed a train enters a "dead" or braking section, which also includes a 1 in 20 up grade, and to ensure absolute uniformity of speed on the receiving section it is brought to a dead stop on the braking section first.

When the train enters the braking section, which is dead, the brakes are automatically applied. At the same time the presence of the train lifts the track circuit relay and a connection is set up that initiates the rotation of the camshaft. The train comes to rest, and after a definite interval from the moment it has entered the section the rotation of the camshaft closes a contactor, which applies 440 volts to the conductor rail. The actual time delay between the stopping and starting of the train is very small, the setting having been found by experiment in each station under every combination of atmospheric, load and emergency conditions.

After 440-volt current has been applied for a few seconds, the further rotation of the camshaft changes the supply to 150 volts, and this supply is maintained until the train leaves the section. The camshaft then proceeds to rotate to the "off" position. The crossover section that follows the braking section is also energised at 150 volts and the train proceeds at a low speed until it reaches one or other of the station sections, which are normally dead, and there it comes to rest.



Courtesy] [*Spencer (Melksham) Ltd.*

Intake end of two Conveyors at Liverpool Street Station. The one on the right carries parcel traffic and that on the left deals with letter bags

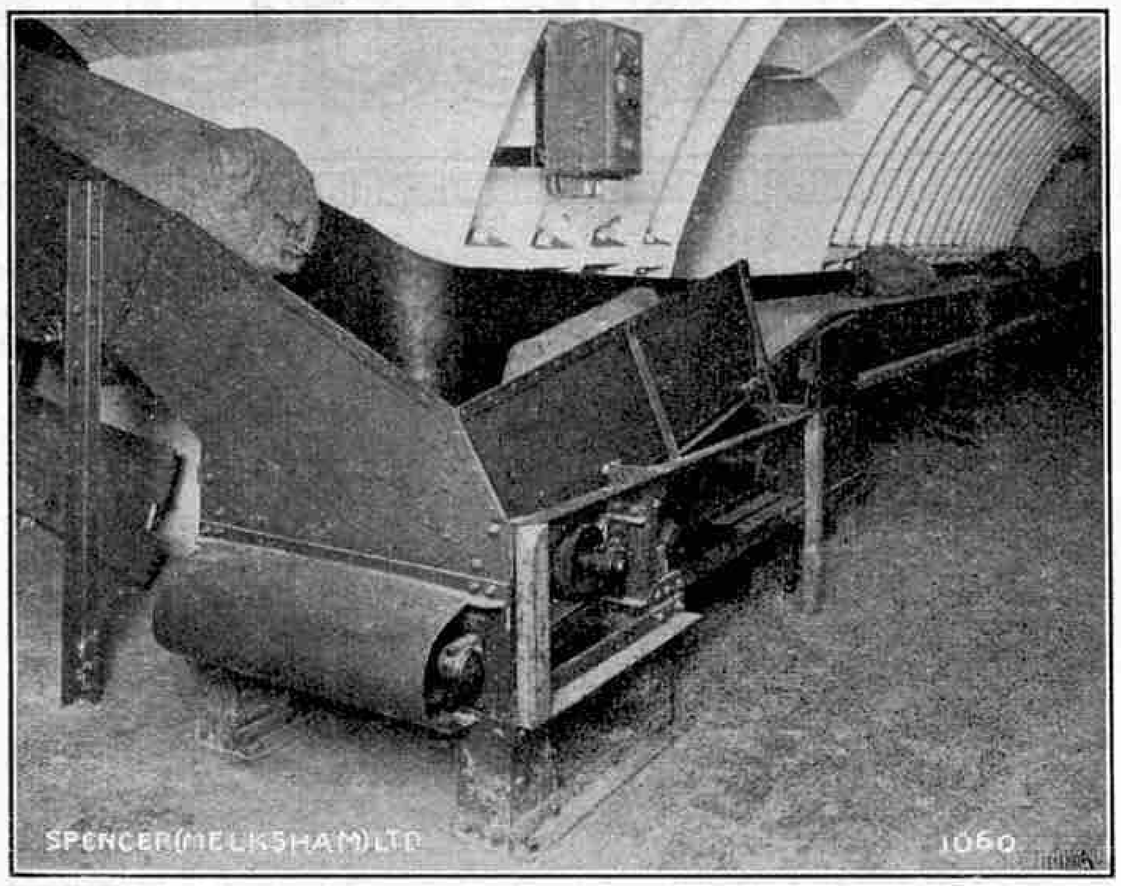
The whole of the train movements are controlled in each station through levers on a control desk, similar to those used on railway power signalling systems, and situated in a cabin between the two platforms. To despatch a train from a station the operator moves the requisite lever, thereby closing an electrical circuit which in turn closes the contactor supplying current to the section on which the train is standing. The train then moves forward and passes from section to section, these sections being automatically energised, but interlocked so that a train in passing renders dead the section behind it. All station operations also are controlled from the control lever desk.

For emergency operation all sections on one road, including the automatic sections controlled by the station concerned, are cut dead if a lever called the "King" lever is pulled.

The system is protected by continuous track circuiting with track relays operated at 24 volts from batteries. The presence of a train on any section of the line completes the track circuit and causes the track relay for that section to pick up. Each track relay works in conjunction with a "stick" or repeater relay, which is normally energised through one of the contacts of the track relay and one of its own contacts. When the track relay picks up it de-energises the stick relay, which therefore drops. When the track relay drops, owing to the train leaving the section, the stick relay does not pick up, as the supply from the track relay through its own contact was broken when it fell away. It is therefore given a "reset" feed to pick it up, from the track relay next down the line when the latter picks up.

This ensures that, if a train runs into a section without occupying it, the section behind it will still be blocked.

In every station there is an illuminated diagram that indicates to the switchman the position of all trains in the station and on the automatic sections at either side of the station. The destination of trains is indicated by a " Send and Receive " board situated in the control cabin. This board is simply a panel with a series of pilot lights and plungers, each alongside a strip on which is painted the name of a station or group of stations. When a train is about to be despatched the switchman presses the plunger against the group of stations where the train is scheduled to stop. This action lights up a white pilot light against this strip in his cabin and also alongside the corresponding panel in the next station. In addition it also lights up a red light alongside the " Receive Next Eastbound " strip at the next station. When the train arrives, the switchman pushes the plunger against this strip, and the three lights are extinguished. These lights and plungers are duplicated, one set on each side of the name strip, so that two trains can be indicated at once. The only difference is that when the second train is described the red light does not come up against the " Receive Next Eastbound." When the first train is cancelled out, the red light automatically transfers itself to the second indication. Illuminated indicators operated by jack plugs from the cabin are placed opposite each platform berth for the purpose of informing the platform staff of the destination of the trains.



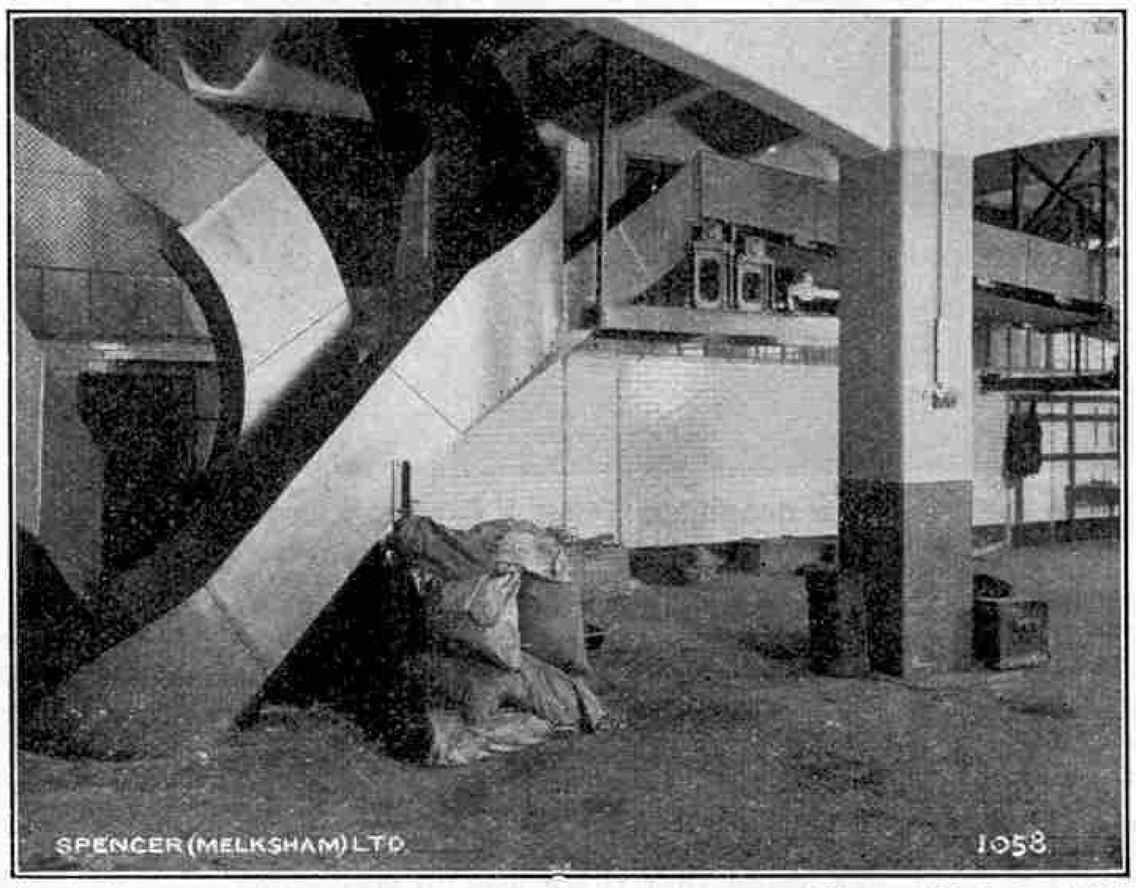
Courtesy] [*Spencer (Melksham) Ltd.*

Mail Bags descending spiral chute to station platform and passing on to a Distribution Conveyor

Catenary wires or plunger switches are provided on the platform, and when a train has finished loading, and is ready for despatch, the platform staff is able by this means to complete a circuit to a red light on the platform indicator and a green light in the signal cabin. These lights are cancelled by a plunger operated from the switch cabin after the train has left.

Certain stations are provided with dead end sidings. With one exception these are single line and have a series of berths. They are entered from one road and left by another in the form of a " Y," and the points that connect the entry and exit roads are automatic. The only part of the shunting operations that is done by hand is reversing a train once it is in a siding.

In order to get as many trains as possible into a siding the berths are made very short, and consequently the speed has to be kept low. It is arranged that any train entering the siding shunts down to the last unoccupied berth, and to keep the speed low a halt is made on every berth that is passed through.



Courtesy] [*Spencer (Melksham) Ltd.*

The delivery end of a Bag Conveyor

The points in the sidings are operated by the position of the trains themselves. In Mount Pleasant siding, which is a twin road approached through a single line bottle neck, there are two sets of points, both of which are automatic. It is believed that these are the only automatic points of the kind in Great Britain other than those recently installed on the Mersey Railway.

At Mount Pleasant there is also a wagon storage and repair depot, connected by a double track of 1 in 20 grade to the main line. The control of trains passing down this inclined road from the depot to the main line is effected in a manner similar to the movements in the sidings. The line is sectioned and the train brought to rest at intervals so as to limit the speed and ensure that entry into the station is made at an easily controlled speed.

Third rail operation in the Car Depot was considered inadvisable and current to manœuvre the trains is therefore taken from a double overhead trolley wire system by means of four-wheeled trolleys running on a steel " I " beam suspended from the roof, with a flexible cable and plug for connection to the wagon.

The control of the trains is from a central control point on an elevated platform. Three hand-operated controls are provided, each controlling one track through a contactor and resistances. The resistances are so graded that, in conjunction with the controllers, single-wagon, two-wagon or three-wagon trains can be adequately controlled. The flexible connections to the trolley are fitted with push button switches, so that when operating at a distance from the control position a shunter can open a contactor on the control platform and stop the train.

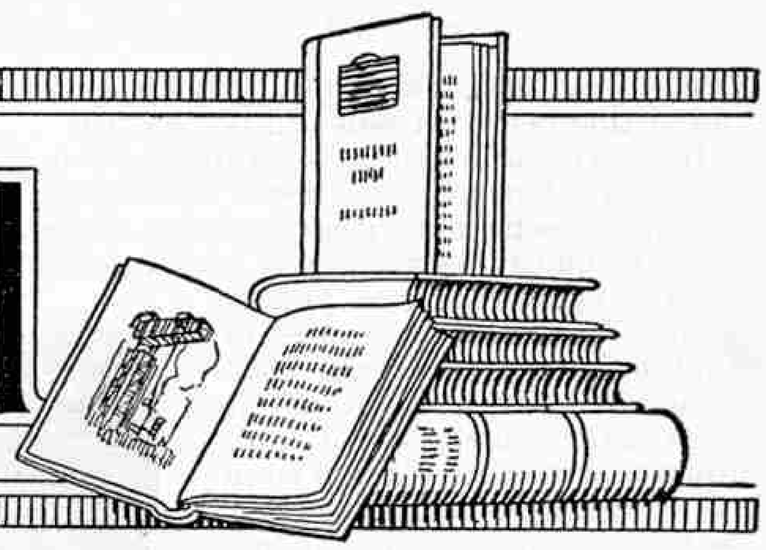
At both terminal and intermediate stations the postal traffic is handled almost entirely by mechanical power. There are spiral chutes for downward mails and lifts for upward mails and at the main stations the traffic operating mechanism includes the installation of electrically-operated conveyor bands situated beneath the station platforms. The sorting rooms up above are connected with the platforms by means of circular shafts, the lower termini of which are beneath the railway platforms. In the floor of each platform at short distances are apertures through which the mail bags from a train are dropped on to an endless band that connects with the conveyors and lifts. The bags are transported by the conveyor to the lifts and from there to the sorting rooms, and are untouched by hand from the moment when they are dropped through the platform apertures.

There are 21 conveyors altogether, operated by individual shunt motors at speeds varying from 30 ft. to 90 ft. per minute. In some instances two or more bands are included in one conveyor, the bands running in parallel and connected together by bevel gearing. The starting and stopping of the conveyors is effected by means of push button control, either from the heads of the conveyors or from the post office railway platforms.

At King Edward Building and Mount Pleasant the horizontal distances between the railway platforms and the post offices above is not sufficient for the use of band conveyors to be practicable, and mail bags are transferred by means of bucket elevators. The path of the elevators might be described as that of the lower quadrant of a circle. At the underground platforms the mail bags are loaded into the buckets, which travel horizontally for a short distance and then follow a course that gradually becomes vertical, finally passing up into the Post Office. The main chains linking the buckets together in series pass round sprocket wheels, the bottom pair of which is driven by a motor operating through worm and spur gearing. The elevators are in continuous operation.

There are 17 lifts in use on the railway. The four lifts at Mount Pleasant are of 30 cwt. capacity and are each 9 ft. by 8 ft. by 7 ft. in height, while the remainder are of 25 cwt. capacity and are 8 ft. by 8 ft. by 7 ft. in height. In all cases the lifts are driven by 440-volt direct current motors and are equipped with both push button and car-switch control. A change-over from one (*Continued on page* 827)

Books to Read



Readers frequently write asking if we can recommend books that are both of interest and of use. On these pages we review books that will specially appeal to readers of the "M.M." We do not actually supply these books, which may be obtained either through any bookseller or direct from the publishers.—EDITOR.

"Cape to Cairo"

By STELLA COURT TREATT
(George G. Harrap & Co. Ltd. 21/-)

Some of our readers may remember that in our November 1926 issue we gave a short account of the remarkable journey of the Court Treatt expedition in motor cars across Africa. This journey has since been described by Mrs. Court Treatt and the remarkable adventures the expedition encountered are thrilling reading. It is the story of persistent endeavour—a constant fight against nature in remote places, under all kinds of conditions, and obstructed by all manner of obstacles—carried through in the true spirit of adventure. As the Earl of Clarendon says in his foreword, it is a matter of taste whether you prefer to have your car held up by a policeman or a rhinoceros; or whether it is pleasanter to be obstructed by the stream of traffic in Piccadilly or by the Zambesi in flood! At any rate the readers of this book will appreciate why there is at present no traffic congestion on the Cape to Cairo route, and no one-way traffic system in the Rift Valley!

The expedition started from Cape Town where a big crowd bade the travellers God-speed. The route then lay through the Orange Free State and the Transvaal into Southern Rhodesia, where a halt was made at the famous ruins of Zimbabwe. The party then worked on to the Victoria Falls, through Livingstone, the Broken Hill, thence through Northern Rhodesia to Lake Tanganyika and east to Lake Nyassa. The trek then turned northward and passed through Tanganyika, by Nairobi and Kenya and through Uganda to Southern Sudan—where there was no wood available for bridge construction. Following the Nile through the Nubian Desert the travellers reached Egypt, passing Assuan and finally reaching Cairo, their goal.

To say the book is enthrallingly interesting scarcely does it justice, for it describes an experience that is only likely to be encountered once in a generation. The two cars concerned travelled 12,732 miles over roads good, bad, and indifferent. At times they had to be hauled through quagmires over their axles in mud, when a fifth of a mile represented a hard twenty-four hours' work! At other times they were ferried across rivers on rafts, or crude bridges were built for them to travel over—a feat that needed no little nerve since the primitive structures were weird affairs lacking nails or bolts! At times the question arose of crossing rivers at places where there was no wood for bridge-building, and on these occasions there was nothing for it but to remove the carburetters and electrical equipment, and for an army of natives to drag the cars through the river—on five separate occasions the cars were completely submerged during this process. Meantime the indomitable party had to swim across, splashing and shouting to ward off the attentions of crocodiles!

The whole enterprise was threatened with failure at the eleventh hour when it was found that there was no way along the river banks at the point where the Halfa to Shallal mountains came down to the Nile. No trustworthy guide could be found, and officials gave gloomy warnings as to what would happen if the party proceeded, but the expedition had not come so far only to give up, and loading with all the water they could carry, they pushed out into the Eastern desert. They failed after three times to get over one of the mountains but at length succeeded, only to find another mountain facing them. Here they were stopped by sheer walls of rock, but on the sixth day of desperate effort they managed to get through. Meantime a search-party had been sent out to scour the desert for them and when they met them the worst was over. There remained only the cultivated lands of Lower Egypt, with Luxor and then Cairo as their final objective.

This splendidly written book of glorious adventure, illustrated by 64 photographic plates, must be classed as one of the finest books that has been published for a long time.

Up to the axles in a quagmire (From "Cape to Cairo" reviewed on this page)

* * * *

"Adventures in Engineering"

By ARTHUR MALLE, M.A.
(Collins Clear Type Press. 1/9)

This little book of six chapters deals with Sir Marc Brunel's tunnel under the Thames; Allen Stevenson's Lighthouse on Skerryvore; Lord Armstrong's development of the Big Gun; Count De Lessep's Suez Canal; Sir William Willcox's Harnessing of the Nile; and Sir William Arrol's Iron Bridges.

We learn that there is no branch of progress or success that so quickly becomes a part of our daily life as the work of our master builders and inventors. The familiarity with which we come to regard the advances introduced, rapidly blinds us to the enormous influence they exert. The Suez Canal, for instance, changed the whole nature of communication with the East and opened the door to a thousand new sources of wealth and prosperity, exactly as the Panama Canal changed the whole national and political face of the world.

Throughout the pages of the book is evident an atmosphere of keen struggles, of failure leading to success, of great works done, and of great characters and abilities such as will, we feel sure, interest all readers of the "*M.M.*"

* * * *

"The Broken Trident"

By E. F. SPANNER (Williams & Norgate. 7/6)

It certainly makes one think when a member of the Royal Corps of Naval Constructors writes a book in which he argues that the Navy is out of date and that Britain must certainly rely on aircraft for future defence! Quite apart from the fact that the author forwards some interesting theories, many of which seem beyond argument, the story is most exciting. Germany, after years of secret preparation, carefully described in detail and all too feasible, declares war. Unlike previous wars, it is not the lust of conquest that sets the war-dogs loose, but Germany's desire to prove that she is entitled to her

place in the sun and that she can hold her own with any country in the world if necessary. To prove this of course, she chooses her old enemy, England. In Germany's secret factories thousands of aeroplanes are waiting, and although she uses her wireless to broadcast every day to all the inhabitants of England, telling exactly what her next move will be, the authorities are powerless, through lack of aircraft, to prevent her carrying out her plans. Docks, warehouses, food stores and roads are all systematically and thoroughly destroyed, so that not only cannot food be brought from overseas but what little there already is in the country cannot be distributed.

The war lasts but a few weeks. After our small fleet of aircraft is destroyed, England's hope is, as ever, centred on the Navy. The best of ships and the bravest of men are no match for skilfully handled aircraft in large numbers, however, and England's last defence is broken down and her Navy wiped out without the chance of striking a single blow.

The plot grips, and the developments are so unexpected all the way through, that whether the reader be a devotee of the Air Force or of the Senior Service, he cannot fail to be thrilled. We are left with a very uncomfortable feeling that undoubtedly there is a great deal in what the author writes, even if we cannot agree with him on all his points. The author states the book is written " to present certain ideas with more force than they would carry in a series of short articles." There is no doubt that the ideas are presented with force and will make a lasting impression upon the reader, and as these come to us from the pen of a naval expert they carry conviction. The book is one that will particularly appeal to those interested in the defence of the British Empire and in the development of ships and of aircraft, but the story has also a general appeal.

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" The 4-Electrode Valve "

By Fred Goddard (Mills & Boon. 3/6)

The possibilities of wireless valves that have four electrodes instead of three (as incorporated in the ordinary type) are fascinating to the minds of wireless constructors and experimenters. Their remarkable efficiency, their capacity for liberal amplification effects with very low high tension current, and their adaptability to circuits that usually employ the three-electrode valve, combine to make the new valves unique for wireless reception purposes.

This book is the first to deal exclusively with the new valve and those who desire to know more about it and how to get the best out of it, will find the facts, which are set out in non-technical language, of inestimable value. The volume contains over 50 circuit diagrams with explanatory notes, the circuits ranging from single to three-valve circuits and including a number of circuits in which the usual high-tension battery is dispensed with.

The action of the valve is fully explained and it is pointed out that one of its greatest advantages is economy in the high-tension battery cost. The author tells us that the most dependable four-electrode valves on the market are designed to operate with a maximum of 15v., although it is advisable to have a slightly higher potential if available.

The four-electrode valve undoubtedly has many unexplored possibilities, and Mr. Goddard's book should prove a stimulus to all who are interested beyond the point of mere broadcast reception.

One of the cars submerged in a river, with Major Court Treatt standing on it (From " Cape to Cairo " reviewed on the previous page)

" Winkles—Schoolboy Detective "

By Rowland Walker (Ward Lock. 5/-)

Although this is a real " laughter " book, it is not confined to laughter alone for there are thrills galore in it. Winkles is just a natural boy who seems to live through the book and the Doctor, a splendid man with a sense of humour that endears him to the boys, is a likeable character also. The whole book is a delightful mixture of humour and thrills. For " creeps "—what can beat the bell that tolls when the wind is in a certain direction—at which time the ghost of the old Admiral parades the Admiral's Walk !—or the occasion on which the Admiral's ghost meets its twin ?

Lively wit abounds throughout the book, but I doubt if anything could be funnier than the story of how the Fifth paraded for breakfast attired in their pyjamas, led by Tom Jay in his zebra stripes festooned with silk braid. The ingenuity of the boys' escapades makes a strong appeal, as also does their splendid team spirit and their sense of humour and justice.

* * * *

" The Fair God "

By Lew Wallace (Fredk. Warne, 2/6)

This historical novel, woven round the deity of the Aztecs and the Spanish conquest of Mexico, opens in the year 1519, when Hualpa, the hunter and would-be soldier, comes to the capital to seek service with the king. The story of bravery and sacrifice, of the intrigue and cunning that surrounded the court of Montezuma the King ; of the devotion of the Lord Guatamozin to his sovereign, and of the daring and skill of Hualpa, who is made a noble and given an honourable place in the King's court, makes fascinating reading. The author has spared no pains in order that his details may be accurate and every date and every happening is in accordance with history.

The coming of the Spaniards was foretold by the pictures in the depths of the temple of Quetzal, but the old priest Mualox, and his followers, were looking for the return of the god Quetzal. When news came of the approaching Spaniards it was believed that their leader was indeed Quetzal. The long struggle that followed, and the privations and sufferings of both sides, are recounted in details, the Christians and the infidels both taking fresh courage after crushing defeats, and rallying again to their cause.

There are over 400 closely printed pages in this exceedingly instructive and interesting book, which is a distinct change from the usual literature of to-day, and one that is to be recommended for all boys who seek a change from fiction yet want a book crammed full of adventures. It has been written that from Mexico a civilisation that might have instructed Europe was crushed out, and certainly after reading this fascinating story one cannot help regretting the passing of this wonderful people with whom it deals.

* * * *

" Science for You "

By J. G. Crowther (Routledge. 5/-)

This book is the first of a new series, which takes its title from the present volume. The " Science for You " series is designed to provide an account of interesting aspects of recent scientific discoveries, each volume consisting of short accounts of the fascinating new work in science. Readers of these volumes should easily find out something of what modern scientists are doing and what they hope to do in the future.

Mr. Crowther's volume contains 27 articles dealing with such varied subjects as Thunderstorms, Stars, Electric Lamps, Ultra-violet rays, Atmospherics, Famous Laboratories and many other subjects in which there have been recent and interesting advances and discoveries.

We feel sure that many of our readers will welcome this new series which will explain in a simple way some of the fascinating scientific theories recently advanced.

Interesting New Books

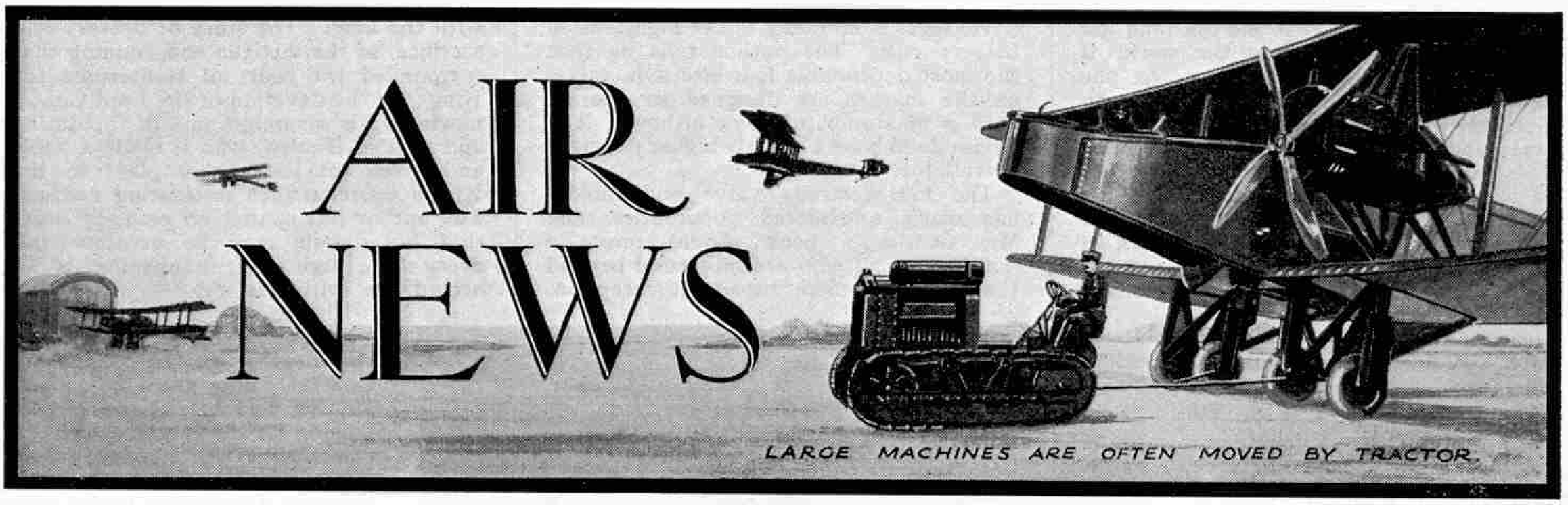
We hope to deal with the undermentioned books in an early issue.

" Traditions of Lancashire "
by John Roby (Fredk. Warne), 7/6

" Gentlemen Prefer Aeroplanes "
Written and published by E. F. Spanner, 35/-

" Our Wonderful Universe "
by C. A. Chant (Harrap), 5/-

" Aerobatics "
by Stewart (Pitman), 5/-



Chinese Aviation

As a result of the return of comparative internal peace to China it is expected that before long a number of air routes will be inaugurated. An Aeronautic Bureau has been created and has already opened a fund to acquire the necessary capital to purchase 20 aircraft. It is proposed to open one route between Canton and Kiangmen, via Siuhing, Wuchow, Sunchow, Nanning, Pehai, Haikow, and Suiting. A second route will link up Canton to Yingtak, passing over Hweichow, Swatow, Sinning, Namyung and Suikwan.

There is vast scope for aerial development in China. Its huge area is comparatively free from natural obstacles to flying and, generally speaking, also is free from serviceable roads. China's transport facilities generally are poor and totally inadequate for the needs of a vast population.

* * * *

"Dusting" Canadian Forests by Aeroplane

Aeroplanes, scientific workers and commercial organisations have combined their forces in an effort to find the best method to control the spruce bud worm in Canada. It is estimated that during the past 20 years this pest has damaged wood to the value of over £500,000. The work being done is purely experimental, and consists of the dusting from the air of twelve 10 acre plots of different types of timber with varying strengths of calcium arsenate. If the dusting method of control can be effectively employed it will mean a tremendous economic saving to Canada.

* * * *

The New Fokkers for Dutch Indies Service

The first of the four three-engined Fokker aeroplanes that will be flown to the Dutch Indies in the autumn, in order to be put into service on the lines of the Nederlandsch Indische Luchtvaart Maatschappy (the N.I.L.M.), is now being tested by Lieutenant Koppen, who a short time ago made a record-breaking flight of 18,000 miles in 20 days on the same type of machine.

The machines are each being equipped with Armstrong Siddeley "Lynx" engines of the improved type, giving 230 h.p. at 2,090 revolutions. Accommodation is provided for eight passengers and the petrol capacity is 275 gallons. An important improvement in these machines is a wheel-brake. This can be operated by hand and reduces the running distance of the machine when landing by at least one half.

As the machines are intended for service in tropical countries, the metal parts of the engines have been specially treated, while the wooden wings have been provided with a triple coat of varnish.

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Commercial Flying in Canada

According to a report on Civil Aviation and Civil Government Air Operations issued by the Department of National Defence at Ottawa, remarkable progress was made in Canada during 1927. The most gratifying feature of the period under review was the fact that commercial flying companies more than doubled their flying time, while the Dominion and Provincial Governments' flying operations increased by 50 per cent. Flying has now become a recognised part of practically every conservation, development and engineering service in the Dominion.

In 1927 the hours flown were 12,070, as compared with 5,860 in 1926, an increase of 106 per cent. The number of passengers carried by commercial aeroplanes increased from 6,436 in 1926 to 18,932 in 1927, and the number of passenger miles flown from 631,715 to 1,424,031. Freight carried increased from 724,721 pounds in 1926 to 1,098,346 pounds last year.

Civil flying for Government purposes totalled 2,028 hours during the year. Of this time 66 per cent. was devoted to patrol of forests for protection against fire or for other forestry operations, while 30 per cent. was taken up in photographic operations for topographical surveys.

* * * *

Flying Parties

An interesting flying novelty has been introduced by Major and Mrs. Fitzgerald, of Marsden Manor, Cirencester, who recently gave a week-end house party at which all the guests arrived by air. On the Sunday a picnic was arranged on Lambourn Downs, and the site of the selected picnic ground was marked by a large "M" within certain known boundaries. The guests were invited to locate the site from the air, and the first person to arrive was Captain de Havilland, who spent only 25 mins. in searching for it.

* * * *

Policing the Desert

A band of desert brigands who had been causing a great deal of unpleasantness in Iraq, was recently located by an R.A.F. machine. The chief of the brigands ignored the pilot's order calling upon him to surrender, but the gang was quietly broken up by the combined action of R.A.F. aeroplanes and police forces.

Aerodrome Night Lighting

In the earliest days of aviation, the principal barriers to progress were the hopelessly inadequate facilities for night flying. Landing at night was a task fraught with serious danger and flying operations necessarily were confined to the hours of daylight. Obviously the advantage of the time gained in flying by day was seriously offset when the journey had to be discontinued at nightfall.

The British Government was the first to realise that ample lighting equipment at landing grounds was the first requirement to promote the safety of the night flyer, and an experimental lighting plant was introduced in 1919 at the Government air-port at Hounslow. This was the forerunner of the modern aerial lighthouse. The lessons gained in those early days pointed the way to the marvellous systems in use at modern aerodromes.

In the place of the single lighthouse with its battery of searchlights is the modern rotating beacon flashing its guiding signal over the countryside to guide the oncoming machine to its home; there are lights ringing the edges of the landing places, with the most suitable points at which to cross the boundaries indicated by special colours. The aerodrome is bathed in light, enabling every feature to be distinguished as readily as by daylight; special lamps illuminate the wind indicators. Floodlights pick out the hangars and form a guide enabling the approaching pilot to gauge his altitude.

* * * *

Light 'Plane Record for Czecho-Slovakia

A world's long-distance record for a single-seater light aeroplane was recently set up by a Czecho-Slovakian pilot, Major Vicherek, who is the Chief of the test-squadron of the Institution for Military Aeronautical Studies. Major Vicherek on an Avia B.H.11 fitted with a Walter 60 h.p. engine made a flight of 1,530 miles in just under 20 hours.

The start of the record-breaking flight was made from Kbely aerodrome, Praha, and the machine took off having a total weight of 1,698 lb. When the machine was eventually forced down by a fault in the petrol system there were still over 132 lb. of petrol left, and Major Vicherek estimated that but for the mechanical defect he could have covered at least another 93 miles.

* * * *

The German Ministries of Commerce and Education recently ordered that all senior boys in the Frankfort schools are to receive four lessons a week in aviation.

New Goodyear-Zeppelin Airship

The Goodyear-Zeppelin Corporation recently launched their latest airship which was formally christened "*Puritan*." This ship is provided with two air-cooled radial motors, is 128 ft. in length, 37 ft. in diameter, holds 86,000 cubic ft. of helium, and possesses a cruising range of 550 miles when carrying two passengers and a pilot. The maximum speed obtainable is 55 miles an hour, and this can be maintained with a complement of four passengers. The ship is to be used for experimental purposes, cross-country flying and the training of students in the Goodyear airship school at Winsfoot Lake, near Akron, Ohio.

* *

880 Miles in 10½ Hours

The Irving Air Chute Company are erecting a factory in Poland for the manufacture of their parachutes. In connection with this building Mr. L. C. Irvin recently flew to Warsaw and back on his Moth. He left his private aerodrome at Letchworth, Herts., one Friday morning at about 9.30 and reached Warsaw at 12 noon on Saturday, having spent Friday night in Berlin.

Having completed all his business he left Warsaw on the following Friday at 10 o'clock, spent the night at Hanover, and arrived at Letchworth the following day. The distance from Warsaw to Letchworth is approximately 880 miles, and as Mr. Irvin covered the distance in 10½ hours' flying time, his average speed was about 80 miles an hour.

* * * *

Liverpool, Belfast and Glasgow Air Routes

A project for the establishment of a regular flying boat service between Liverpool, Belfast and Glasgow is being considered by the Aerial Taxis (Scotland) Company. Permission to use temporarily the Renfrew aerodrome at the Glasgow end and the Malone aerodrome at Belfast has already been secured, while suitable points in the Liverpool area are under consideration.

Aerial Taxis propose to use the de Havilland "Canberra" type of aeroplane. This machine is fitted with a Bristol-Jupiter 510 h.p. engine, and has a range of 450 miles, a maximum speed of over 130 miles an hour, and a paying load of nearly one ton.

* * * *

A daily service for the aerial transport of passengers and mails has been inaugurated by the "Deruluft" Company between Riga, Königsberg and Berlin, and Riga, Smolensk and Moscow. The machines used on the service accommodate six people, exclusive of the pilot and two mechanics.

Swiss Air Routes

Aviation in Switzerland is progressing rapidly and there are now two Swiss companies regularly operating over commercial air routes, making pleasure flights over the summits of the Alps, taking aerial photographs, and undertaking advertising by skywriting. The two Swiss companies are the Ad Astra and the Balair. There are also four foreign companies flying machines over recognised routes into Switzerland—Imperial Airways, Air Union, Deutsche Lufthansa, and the Koninklijke Luchfaart Maatschappij.

The Goodyear-Zeppelin "*Puritan*"

The following figures show the proportion of the business secured by the Swiss companies during 1927 :—

	Total Swiss Companies	Total Foreign Companies
No. of flights	2,210	2,897
No. of hours	2,593	4,561
No. of passengers ...	5,615	7,495
Miles covered	196,988	373,459
Mail carried (lb.) ...	50,356	52,535
Freight „ (lb.) ...	52,476	130,340
Luggage paid for (lb.) ...	18,190	39,207

There are now 16 regularly flown and advertised air routes in operation, as compared with 13 operating throughout 1927. It is interesting to note that the longest regularly flown non-stop service in Europe is the Zurich-Berlin route, which is worked jointly by the Ad Astra Company and the Deutsche Lufthansa.

* * * *

The Autogyro's 3,000 Mile Tour

The Autogyro invented by Senor de Cierva and piloted by Captain Rawson, has successfully completed a tour of 3,000 miles. This machine is the first to solve the problem of vertical descent. No banking or diving is necessary when landing; the engines are shut off and the machine slowly descends in comparative silence from any reasonable height. When the Autogyro landed at Hamble, on the completion of the tour, a vertical descent from 3,000 ft. was made to Hamble Aerodrome.

It will probably be remembered that the Autogyro was flown in the King's Cup Air Race, but unfortunately the machine ran out of petrol and Captain Rawson was compelled to make a forced landing near Nuneaton, damaging the machine in the process.

New Light Aeroplane Altitude Record

Captain G. de Havilland, with Mrs. de Havilland as passenger, recently reached a greater altitude than has ever before been attained by a light aeroplane. He left Stag Lane Aerodrome in a 100 h.p. Gipsy Moth similar to the King's Cup machine, and climbed over 21,000 ft. in 70 mins. This exceeds the height attained last October by two Germans, who succeeded in reaching 18,700 ft.

When Capt. de Havilland was flying at 20,000 ft. the temperature was 27° below freezing point, and resort had to be made to the oxygen breathing apparatus. It is his firm belief that the height he reached is by nó means the maximum ceiling of a light aeroplane.

* *

Imperial Airways' Persian Route

The difficulties that have hitherto prevented the operation of Imperial Airways' Far East route through Persia are now in course of solution, and it has been decided to construct in Southern Persia five aerodromes, at Bushire, Bunda Abbas, and three other points yet to be decided upon. These will provide a link with Baghdad for the existing air mail line from Teheran, via Ispahan and Shiraz.

The agreement that has been concluded between Great Britain and Persia will enable Imperial Airways' route to be worked through to India from Cairo, and will complete the project for the London-India route that it is hoped to establish in April next.

* * * *

South African Speed Record

A speed record was recently made by Colonel Sir Pierre van Ryneveld at Swartkop Aerodrome, in South Africa. Colonel van Ryneveld was flying a D.H.9, fitted with a "Bristol" Jupiter 450 h.p. engine, and he attained a speed of 138 m.p.h. This figure does not convey the true merit of his performance, however, as the aerodrome is approximately 5,000 ft. above sea level. This speed at 5,000 ft. is equal to about 150 m.p.h. at sea level.

Colonel van Ryneveld is the Director of South African Air Services and, in addition to setting up an altitude record a short time ago, he was the first man to make a parachute descent in Africa.

* * * *

Air Mail to Scandinavia

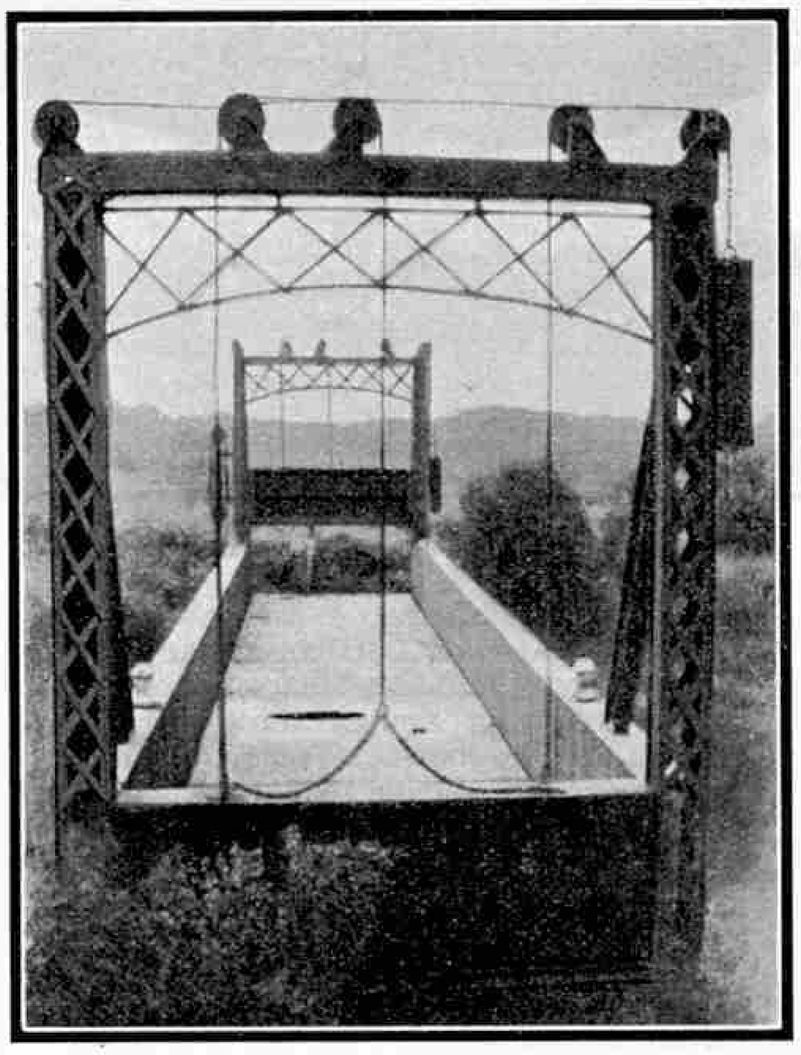
A Junkers single-engined monoplane recently delivered at Croydon 500 registered letters from Scandinavia. There were also many parcels and ordinary letters on board. The machine flew via Oslo, Copenhagen and Amsterdam, and it is hoped that a regular air mail between London and Scandinavia will soon be in operation.

The Mechanical Locks at Foxton

Some time ago I visited the once famous mechanical locks at Foxton, 10 miles from Leicester, which have now been standing idle for 15 years. At this place the Grand Junction Canal meets the Union Canal, one being 100 ft. higher than the other. In order that barges might be transferred from one canal to the other 10 locks were built. 50 years ago, but towards the end of last century traffic became so heavy that mechanical locks were installed in order to speed up the transfer. These were used until 1912, by which time road traffic had superseded waterways to such an extent that the locks did not carry sufficient traffic to pay for their upkeep.

At first sight the locks remind one of a giant Meccano funicular railway. Two huge iron tanks, each having 16 wheels, run on four pairs of rails up the slope from one canal to the other. These tanks are 7 ft. in depth, 15 ft. in width and 70 ft. in length. Each weighs 200 tons when empty, and holds 100 tons of water.

Four 4 in. steel cables are fastened to each tank, and pass round large pulley wheels at the top of the slope to a 5 ft. winding drum. This drum has a massive gear wheel, 10 ft. in diameter, which engaged a worm wheel driven by a single-cylinder steam engine.



One of the tanks of the mechanical locks at Foxton with the far gate raised

When a barge was to be brought up, one of the tanks was run into the water at the bottom, the barge was towed in, and the end closed. The tank was then hauled up the rails to the top, the journey taking about five minutes.

At the top the tank fitted closely against another fixed tank that joined the main canal, and when the intervening doors were opened the barge was towed out into the canal. In this manner one barge could be taken up and another down at the same time, the weight of the rising tank being partially balanced by the weight of that going down. The use of this method resulted in the saving of half an hour in comparison with the old lock system.

The machinery and tanks have been regularly cleaned and kept in good order, as they are valuable, but work has now been commenced on the demolition of the apparatus. The huge chimney that was a familiar landmark for many years has already been felled, and the boiler house is being dismantled.

G. W. Weston (Foxton).

From Greenock to Glasgow

I had a very interesting trip up the Clyde recently when I crossed from Ireland to Glasgow. The boat on which I sailed reached Greenock at about seven o'clock, where we stopped for about an hour putting off passengers and cargo. At about eight o'clock we started again, just as the sun rose over the hills, flooding the river in golden, sparkling light. Ten minutes later we passed a sewage ship, of which Glasgow has two. From the outside one would never guess what they are, as they look so clean and tidy.

About a mile higher up from Greenock on the opposite side a number of small "tramps" were collecting sand for the new docks at Glasgow. Later we came to Dumbarton Rock, which towers high above the river. This rock rises almost vertically from perfectly flat ground to a height of about 300 ft.

The nearer we got to Glasgow the more interesting things became. Speed had to be reduced to about five knots so as not to disturb other ships by the wash. We passed one large dockyard where two destroyers were in course of construction, H.M.S. "*Canberra*," and H.M.S. "*Australia*." I was greatly struck by the large number of dredgers at work up and down the river. These do not hold the mud themselves, but deposit it in hoppers moored alongside. Most of the dredgers are of the bucket type, the buckets tipping the mud down a shoot into the hopper. When one of these is full it goes off to be emptied, while another takes its place. Of course it is very important always to have the channel clear, and it is only by constant dredging that the way to the docks is kept clear for large vessels.

At about nine o'clock we reached Merklands, where we stopped to put off cattle, which took about three-quarters of an hour. Merklands is a suburb of Glasgow and contains the cattle market of the great city. Between there and Glasgow we passed several large cargo boats, but no passenger boats. Half-an-hour later we moored alongside the quay at Glasgow, where everybody disembarked and the busy work of unloading the cargo was started. Then the crew, having washed down and cleaned up, obtained a well-earned rest. Most of the passengers disappeared at once, but I was very reluctant to leave the fascinations of the water front, where boats that had brought cargoes from many foreign countries were to be seen.

A. Welch (Rutland).

An Afternoon Underground

On a recent holiday afternoon a friend and I set off to Kirkdale, where there was a cave that we wished to explore. This Yorkshire cave was discovered as long ago as 1821, when the bones of many animals, some of them now extinct, were found in it. The opening presented a rather gloomy aspect, much the same, perhaps, as that of most caves, but there was a darkness and a narrowness about it that gave it a somewhat sinister appearance.

We were soon standing inside and, torch in hand, started off along a winding passage. It was eerie enough, and we could hardly help letting our imaginations turn to the dangers of the situation. Even the thought that it had stood without change for many thousand years scarcely convinced us that the roof would not choose this particular time to fall and cut us off from the outer world!

After going on for about 30 ft. it became necessary to crawl as the tunnel became considerably narrower and lower. We noticed, too, that the walls were smooth. This is due to the fact that originally water used to rush through the cracks of the rock to form the large cave as we have it now.

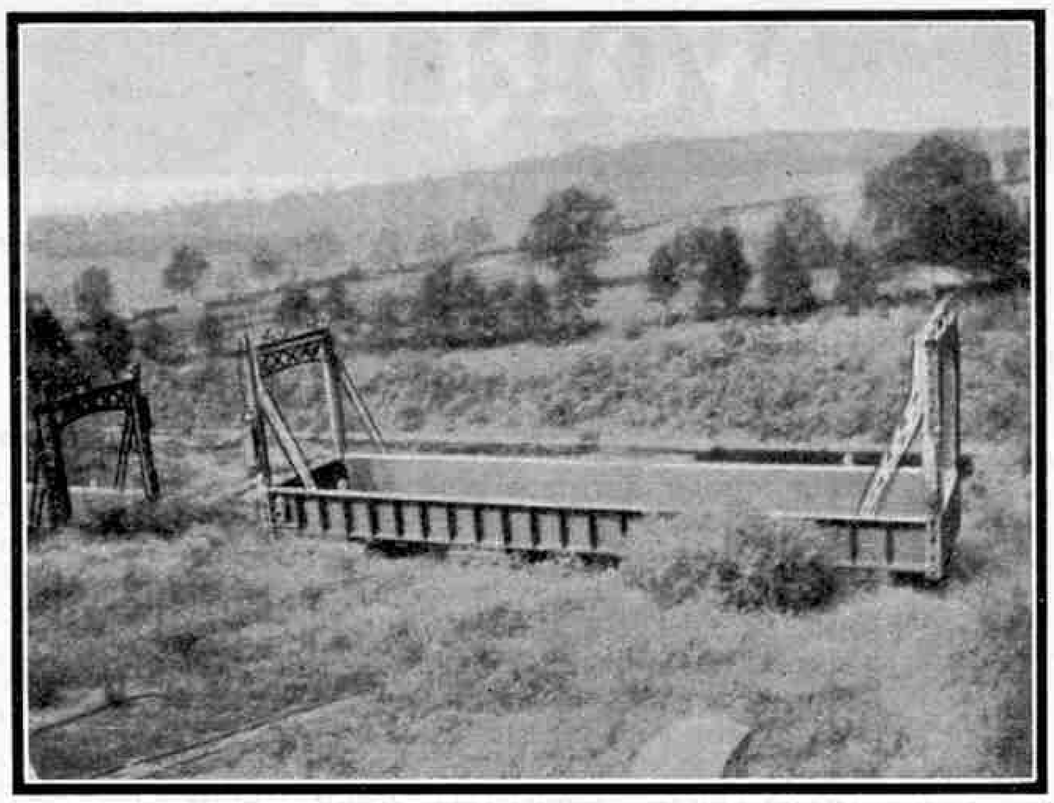
We soon found ourselves in a most awkward position. At every step the floor became wetter and wetter and soon revealed a pool of water, while to add to our discomfort the roof had made a sudden incline and came down within about 2 ft. of the surface of the pool. Through this we had to crawl, getting horribly wet and muddy and beginning to feel very miserable!

The path now divided and we were at a loss to know which was the right branch to take. We decided to follow the left-hand one, and greatly to our joy this sloped upward and so was free from water. At first we were able to crawl easily, but after a short distance it became so low and narrow that we were once more forced to lie on our stomachs and wriggle slowly along. Fortunately there was no water this time.

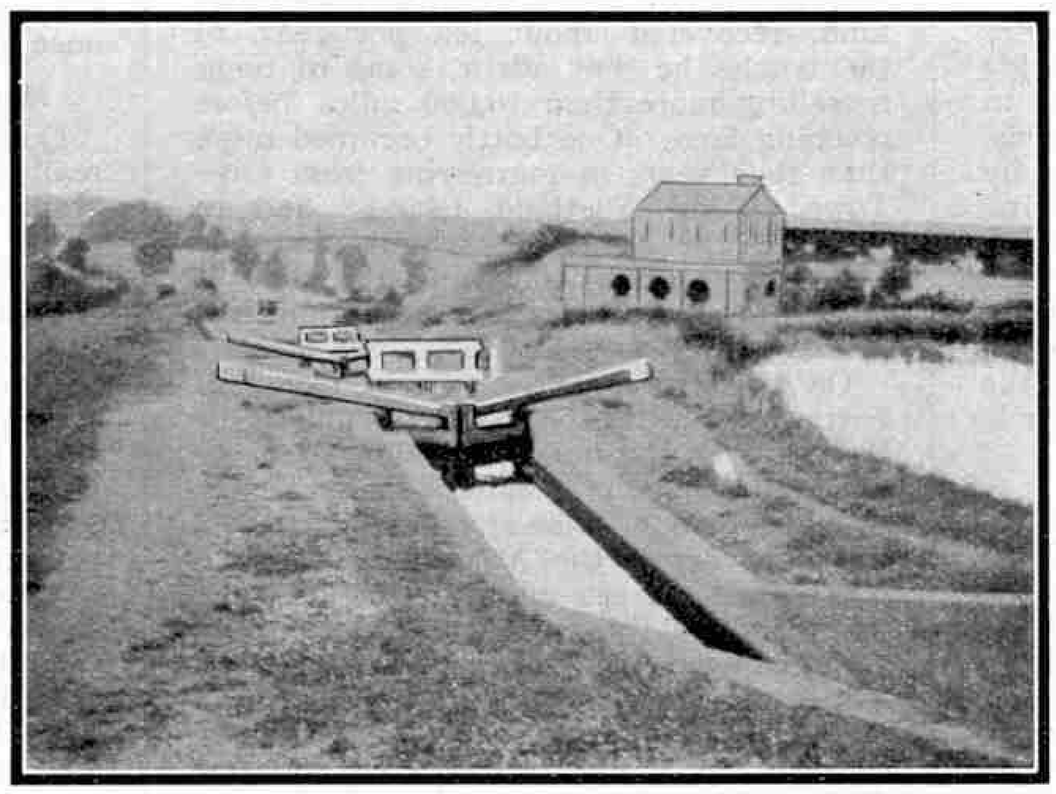
When we had proceeded in this way for rather more than 30 ft. the passage ended abruptly and we found ourselves in a most uncomfortable position, as we could not turn round, and it is considerably harder to wriggle backward than forward. The air, also, was very bad, as there was no through ventilation, and we were nearly stifled. However, at last we got back to the main passage and tried the other direction, which led us to the end of the cave, about 300 ft. farther, without any more disasters.

When we returned to the opening we were quite done up and we were sitting down resting and eating the food we had brought with us when we had another fright. Suddenly, and without any noise, in at the mouth of the cave leaped what, for the moment, we took to be a brown dog. On seeing us it was gone like a flash. We scrambled hurriedly to the edge and looked over just in time to see a fox making the best of his way into his den, in which he was living as the hyenas had lived countless ages ago.

E. T. M. SWENEY
(Ware, Herts.).



This view shows the tanks halfway up the slope between the canals at Foxton. The rails on which they ran can be distinguished in the lower left-hand corner



One of the ten ordinary locks that originally connected the Union and Grand Junction Canals at Foxton

An Adventure with a Snake

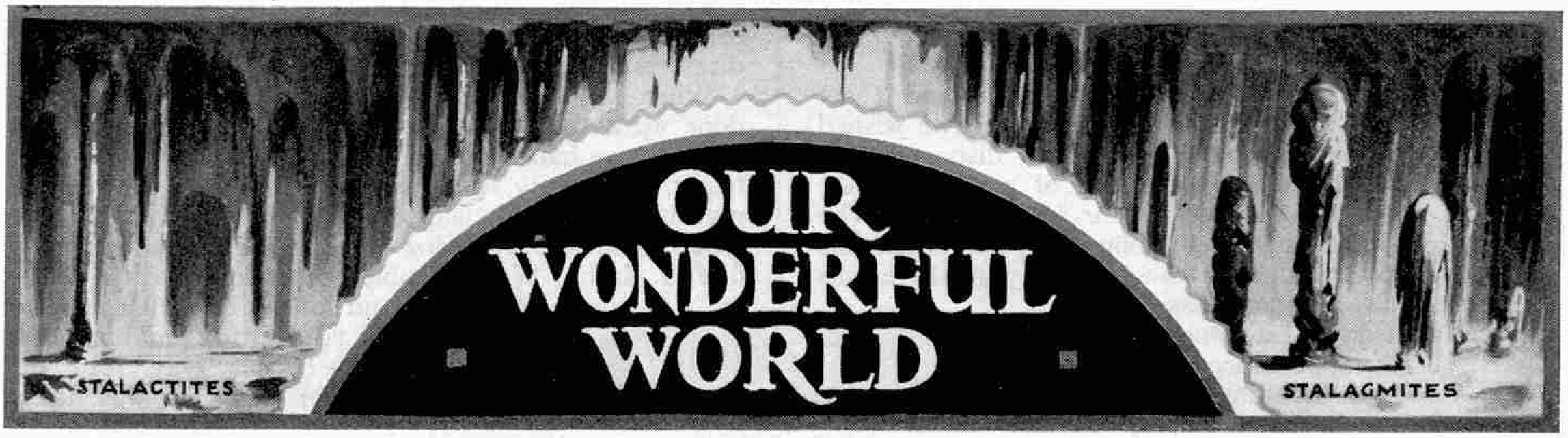
We live on the outskirts of the Golden City of Johannesburg. One day my elder brother and I were playing cricket in the back garden, when Gyp, our fox terrier, suddenly started barking furiously and excited shouts came from our native servant:—"*Baas Beeli! Baas Beeli!* Quick! Very bad thing here!" My brother and I rushed to the scene of action, which was a pile of rubbish overgrown with weeds, wondering what was the matter.

Our native drew back the tall growth and we were confronted by the head of a snake. The half-frightened reptile drew back, and Gyp, thinking himself to be the triumphant, very foolishly rushed forward. The snake immediately lurched forward and tried to get hold of him. It was so fully occupied in this manner that it did not see my brother who had quickly grasped the situation—and a cricket bat. The latter he brought down hard just above the head of the snake and followed up with another in the middle of the back. Urged on by the excited cries of the native, he swiped at it cricket fashion. The bat broke, but the snake was dead.

On measurement we found that the creature was a little over 5 ft. in length. It belonged to a species known to the natives as "Ibululu," the bite of which is said to be fatal.

Two days later an "Injanga," or witch-doctor, appeared. He must have heard of our kill, for he asked if he might have the body of the snake. We had buried it, but to his great delight we dug it up for him. Before he left he had a mysterious conversation with our house boy on what he intended to do with the dead snake.

C. W. WELSH (Cape Province), S.A.



Plants Breathe Like Animals

Reference was made in these columns in the "*M.M.*" for October last to the importance of chlorophyll, the green colouring matter that enables a plant to absorb carbon dioxide, a process that ends with the formation of starch within the plant itself, and the liberation of oxygen. Although gases are concerned in this process, it is one of feeding rather than breathing, and as it takes place under the influence of light it is called photosynthesis, the second part of this word meaning building-up.

True breathing or respiration does actually occur with plants, but is quite overshadowed by photosynthesis, which is 30 times more active in healthy green plants in sunlight. Breathing takes place continuously and all parts of a plant are concerned in it. It is exactly like the breathing of animals, for oxygen is absorbed and carbon dioxide then liberated as a result of a slow decomposition in which the tissues of the plant are destroyed by oxidation. The temperature is raised in plants just as in animals, but as the former have very large radiating surfaces in comparison with their bulk they lose heat so quickly that their temperature is practically that of their surroundings.

It will be seen that the two processes appear to be antagonistic, carbon dioxide being absorbed and oxygen liberated in one, while in the other the reverse happens. In respiration the starch built up by photosynthesis is destroyed, but owing to the greater activity of the latter process growth proceeds at a greater pace than destruction under normal circumstances, in spite of the fact that only the green parts of a plant are concerned in the building-up process, whereas the whole of a plant is concerned in breathing.

* * * *

Sunshine Records in Fossil Trees

Some interesting facts regarding the Sunspot cycle have been discovered by Canadian astronomers. It is generally accepted that Sunspot activity reaches a maximum every 11 years, subsiding slowly to a minimum and then increasing once more during the intervening period. Various attempts have been made to connect this periodicity with terrestrial events, and with other results the annual growth of vegetation has been shown to depend upon the size and number of spots on the Sun. This is shown particularly by the rings that measure the annual growth of trees. As the heat radiation of the Sun is least when the spots are most numerous, the rings for the years in which this condition prevails are narrower than for other years.

From certain records the well-known English astronomer, E. W. Maunder, showed that Sunspots were almost non-existent for a long period at the end of the 17th and the beginning of the 18th centuries, and this has been verified by Canadian scientists by a study of the rings of the long-lived pine trees of Arizona. Other similar dormant periods have been shown to have occurred at several earlier stages of history. The earliest period thus recorded and now revealed to us lasted from 1,000 B.C. to 300 B.C., and a similar one covered the period of English history in which Saxon rule came to an end and the Norman conquest was accomplished.

Even more remarkable results have been obtained from the study of fossil trees. Some of the fossils examined dated back probably not less than 300,000 years and the 11-year period that we know to-day was plainly marked in the rings that show the annual growth of trees that have long been turned to stone.

* * * *

Remarkable Ocean Voyages of Bottles

Remarkable voyages have been made by bottles thrown into the sea at various times in order to test the direction and strength of ocean currents. Captain Simpson, who made many experiments of this kind, recovered about ten per cent. of the bottles he sent adrift, some of them travelling more than 10,000 miles before reaching land. One bottle occupied more than four years in journeying from Cape Town to the Shetland Islands, and in view of the varying currents and the circuitous nature of the route that it must have followed the time is not surprising.

On the average, the rate of travel of bottles afloat in the ocean seems to be less than half-a-mile per hour, but occasionally much greater speeds have been recorded. When Hawker commenced his flight across the Atlantic he threw a bottle into the sea off the coast of Newfoundland and this travelled the 1,900 miles to Stavanger in Norway in six months. The greatest speed was achieved by a bottle that was released off the Dorset coast in 1913 and picked up near New Zealand 11 months later, while the honour of being the slowest known seems to belong at present to one that covered the 15,000 miles from Stewart Island, south of New Zealand, to Queensland in 32 years!

In recent experiments of this type Dr. Beebe, the naturalist and explorer, dropped more than 1,000 bottles into the Caribbean Sea. Of these 31 were recovered within a short time, mostly on Central American shores, but one was picked up on the Irish Coast after spending a year on its voyage of 2,800 miles with the Gulf Stream across the Atlantic Ocean.

Underground Spring Gives Out Valuable Gas

In the valleys of several rivers that enter the Indian Ocean near Port Shepstone, in Natal, it was discovered a few years ago that carbonic acid gas was present in the atmosphere in unusually large quantities. The proportion in which the gas was present made it evident that it was being exhaled from the ground. A hole was therefore bored into the earth at an angle, in the hope of tapping the underground spring that was the source of the gas. The trial proved quite successful. Other boreholes have since been made, and now the gas is being regularly collected and purified, after which it is distributed for use in the aerated water, sugar and other industries, and for use in refrigerating plants.

The supply is led through pipes into a tank or gasholder, from which it passes through several vessels containing calcium chloride to remove the moisture. It is then compressed to liquid form in coils surrounded by running water and the liquid is pumped into steel tubes that hold about 55 lb. of the gas. The supply is not very great, and it has been found that after running 2½ hours the compression must be stopped for a similar period in order to allow sufficient gas to accumulate once more.

* * * *

Mountain Summits Removed by Ice

Quite a large proportion of Germany is really Scandinavia. This reads like geography gone mad, but the statement is quite true. Three times in the history of the Earth great glaciers originating in Norway have pushed in a southerly direction towards Russia, Germany and Holland, and across the North Sea. These huge currents of ice stripped the mantle of soil and disintegrated rock fragments from the hills and mountains of Scandinavia and transported it into the countries named, penetrating as far south on one of these advances as the Hartz mountains, and across Saxony almost to the ranges encircling Bohemia.

A truly enormous quantity of ice must have been concerned in this movement, for the depth of the ice sheet when it reached the Hartz mountains was so great that traces of it are found at a height of 1,400 ft. above sea level. In Norway itself the layer of ice must have been at least 6,000 ft. in thickness. It is not surprising, therefore, that an immense amount of earth was transported from Norway. The soil of the plains of North Germany and north-west Russia is of considerable depth, probably in places as much as 135 ft., and practically all of this may be regarded as having been scraped off the mountains of Scandinavia by the great glacier.

Rotating Lift for Garages

The high value of land and the great increase in the number of cars now running in this and other countries have made one-floor garages uneconomical as compared with those having two or more floors and provided with lifts to handle the cars. A lift of the ordinary kind is unsuitable for this purpose, but the difficulty has been overcome by the invention of a lift of circular design that can be given a rotary as well as a vertical motion.

On each floor a steel structure having one door is built round the lift and this structure also can be rotated. The space round this steel structure is divided radially into a number of compartments each opening on to it and of sufficient size to take one car. A car coming in from the street and requiring garage room is run on to the lift and carried up to a floor on which a compartment is available. The lift is then rotated until its door is opposite an empty compartment and the steel structure is rotated so as to bring its door and that of the lift together. The two doors are then opened and the car is run off the lift into its compartment. Special mechanism is fitted to prevent the lift from turning or moving up or down until the doors of the revolving structures on every floor are locked.

This "Turn Lift," as the invention has been named, is stated to cost only about 10 per cent. more than an ordinary fixed lift, which is by no means an excessive extra cost in view of its value in assisting the economical distribution of cars. The whole apparatus is electrically driven and controlled.

* * * *

Tunnels 40 Miles in Length Suggested

It has been discovered recently that in the desert west of Egypt there is a large area below sea level. This is situated about 130 miles to the west of Cairo and covers about 70,000 sq. miles. It has often been traversed by Arabs, as a well-known camel-track and trade route runs along its whole length; but its low level was not suspected until a cavalry patrol, while travelling through the district during the war, observed surprisingly high readings of the barometer. Dr. Ball, the Director of Desert Surveys, realised that a possible explanation of this high reading was that the area in which it was observed was below sea level, and therefore made arrangements to have a survey made. This finally made it clear that a district 100 miles in length and 70 miles in width is, at its deepest part, 440 ft. below sea level.

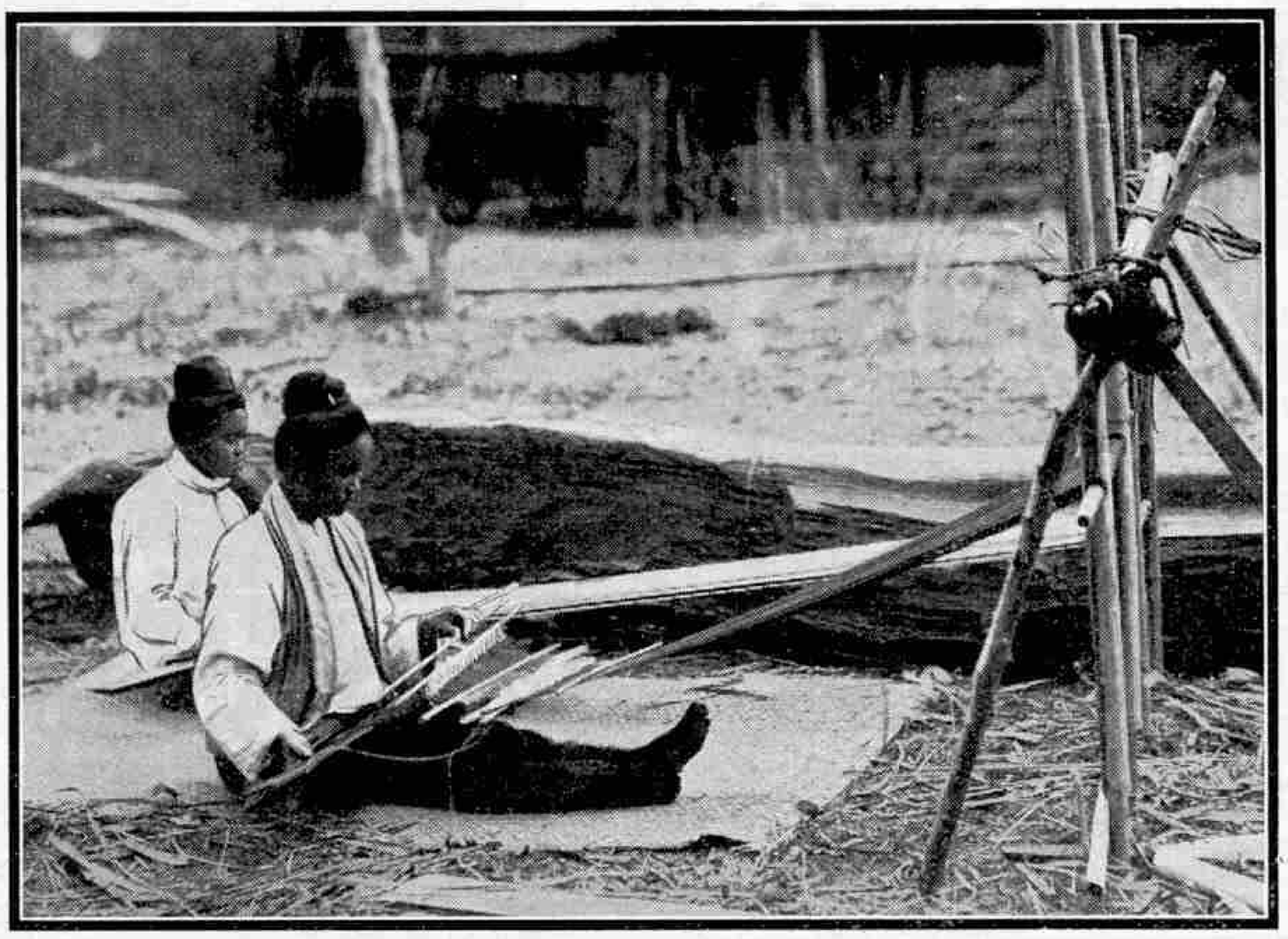
On the north and west the depression is bounded by hills, while a large portion of it is inaccessible owing to the existence of salt marshes. These marshes suggested that possibly an arm of the Mediterranean Sea once extended into the area and that the communicating channel had become choked up with silt and sand. Careful search failed to reveal any trace of such a channel, and it seems clear that no communication with the Mediterranean Sea has existed for thousands of years.

While the search for an easy channel was being made, a striking scheme suggested itself. This was that tunnels should be driven through the hills between the depression and the Mediterranean Sea in order to form an inland lake. Such a lake would modify the climate of the coastal districts of Egypt very considerably, but while questions of evaporation were being considered, it quickly became evident that an enormous quantity of water could be dealt with. Dr. Ball calculates that 40,000,000 tons of water could be passed daily through tunnels into the depression without altering the level of the lake that it is proposed to form, as an equal quantity of water would be evaporated in the same time through the operation of natural causes. As there would be a difference in level of approximately 160 ft., this means that an almost perpetual source of power would be available.

Whether the project will be carried out depends entirely on cost. The tunnels that it would be necessary to construct would be about 40 miles in length, and thus would be by far the longest in the world; while they would have to be of very large diameter to pass the quantity of water required to give any results of value. Trial borings on the line of the tunnels are to be made before a final decision is reached. If the scheme is adopted and carried out successfully it is anticipated that an output of 160,000 h.p. will be available for use in Alexandria, Cairo and the Nile Delta.

* * * *

How many muscles are used in sneezing? It will probably be a surprise to learn that the number is more than fifty! Almost every muscle in the body is affected to some extent.



Natives weaving with hand loom in Burma

Automatic Ore-Sorting Machine

An astonishing machine for sorting ore after the preliminary crushing has been constructed by the research staff of a College of Mining in Michigan, in the United States. Its use entirely abolishes the necessity for laborious hand-picking on travelling belts, which is at present practically the only method available for separating ore from rock and dirt of no value. The machine first decides the value of each piece of ore by merely looking at it and then lifts it out if it is sufficiently valuable!

The apparatus is in two parts, one of which may be described as the eye, while the other is an automatic pick-up controlled by it. The former consists of a mercury arc light and a photo-electric cell. It is placed above a travelling belt on which the ore is carried past, so that light is reflected from the material to the photo-electric cell. The colour of the light that actuates the cell is arranged to be that reflected by good ore. Consequently, when pieces of schist or dirt that reflect light of any other colour are passing, nothing happens, but the appearance of a piece of genuine ore causes the cell to actuate a relay that brings the automatic pick-up into operation.

The second part of the apparatus acts in the same way as a vacuum cleaner. A tube connected with a powerful pump is placed with its mouth close to the travelling belt and the powerful suction that comes into play when the "eye" sees a piece of ore picks this up and carries it away to a storage bin from which it may be removed for treatment.

The case of pieces of material containing only a proportion of ore is met with by adjusting the sensitivity of the cell and relay to make them respond to light containing a definite proportion of the particular colour reflected by the pure ore. The proportion of the ore present in any piece is indicated by the colour of the light reflected from it, and matters are so arranged that only those pieces containing sufficient ore to make smelting profitable are lifted out by the vacuum tube.

* * * *

Is a Rifle Bullet in Flight Visible?

In spite of its speed, it is quite easy to see a bullet during its flight by making use of a telescope placed alongside the rifle barrel. As it moves away in the line of sight the bullet will apparently decrease in size, but the only movement visible will be the fall towards the ground. The rate at which this takes place is exactly the same as that of a piece of lead allowed to fall from the same height and thus the flight of the bullet may easily be followed for a fraction of a second, especially if it is seen against a white background.

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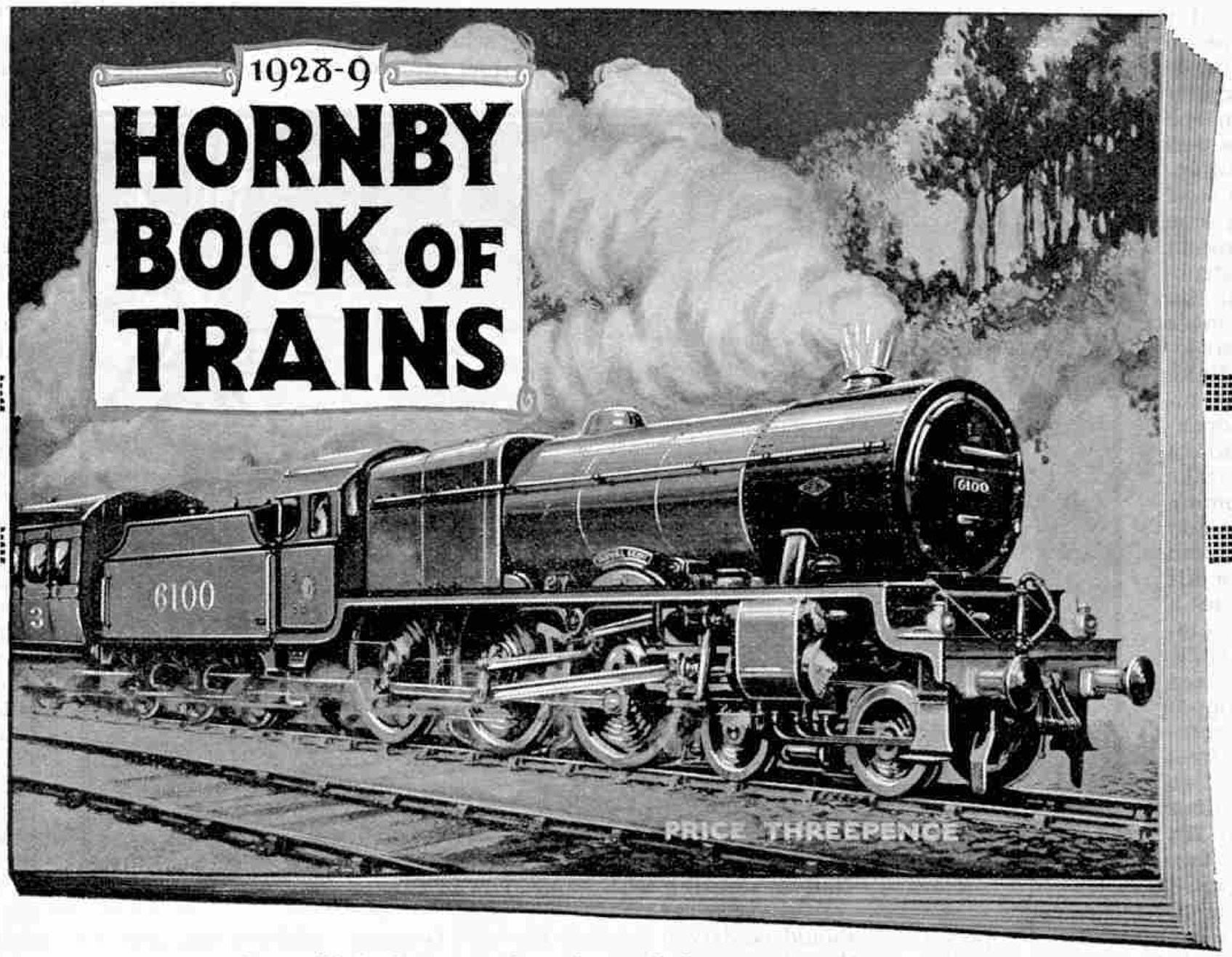

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Story of the Motor Car —(*continued from page* 811)

motor the benefit of every possible method of facilitating its work. The motor may have no difficulty in turning a cold engine; in most cases it is even capable of propelling the car at a tolerable rate of speed; but its use for such purposes involves the use of excessive currents that will eventually ruin the battery completely.

The most interesting feature of modern electrical starting gear is the ingenious Bendix pinion, the use of which is now almost universal. Its purpose is to disengage the starter when it has performed its work. With ordinary gearing the engine, when started, would overrun the starting motor, and the consequence of driving the latter at excessive speeds for any length of time may be disastrous.

The Bendix pinion moves along a thread cut on the end of the shaft of the starting motor. It is not made in the manner of an ordinary pinion wheel but is weighted on one side. This has the effect of holding it sufficiently still when its shaft rotates to cause it to slide along the shaft towards the body of the motor. As it does this the teeth on its outer circumference mesh with those cut on the circumference of the engine flywheel. When it reaches the end of its track the pinion rotates with the shaft of the motor and turns the engine over. The shock of taking up the drive is lessened by the use of a spring on the end of the shaft.

The pinion will continue to turn with the shaft until the engine starts and begins to drive the starter. Then it tends to rotate more quickly than the shaft, and its direction of rotation is such that it winds off the thread and so slides out of engagement with the gear wheel.

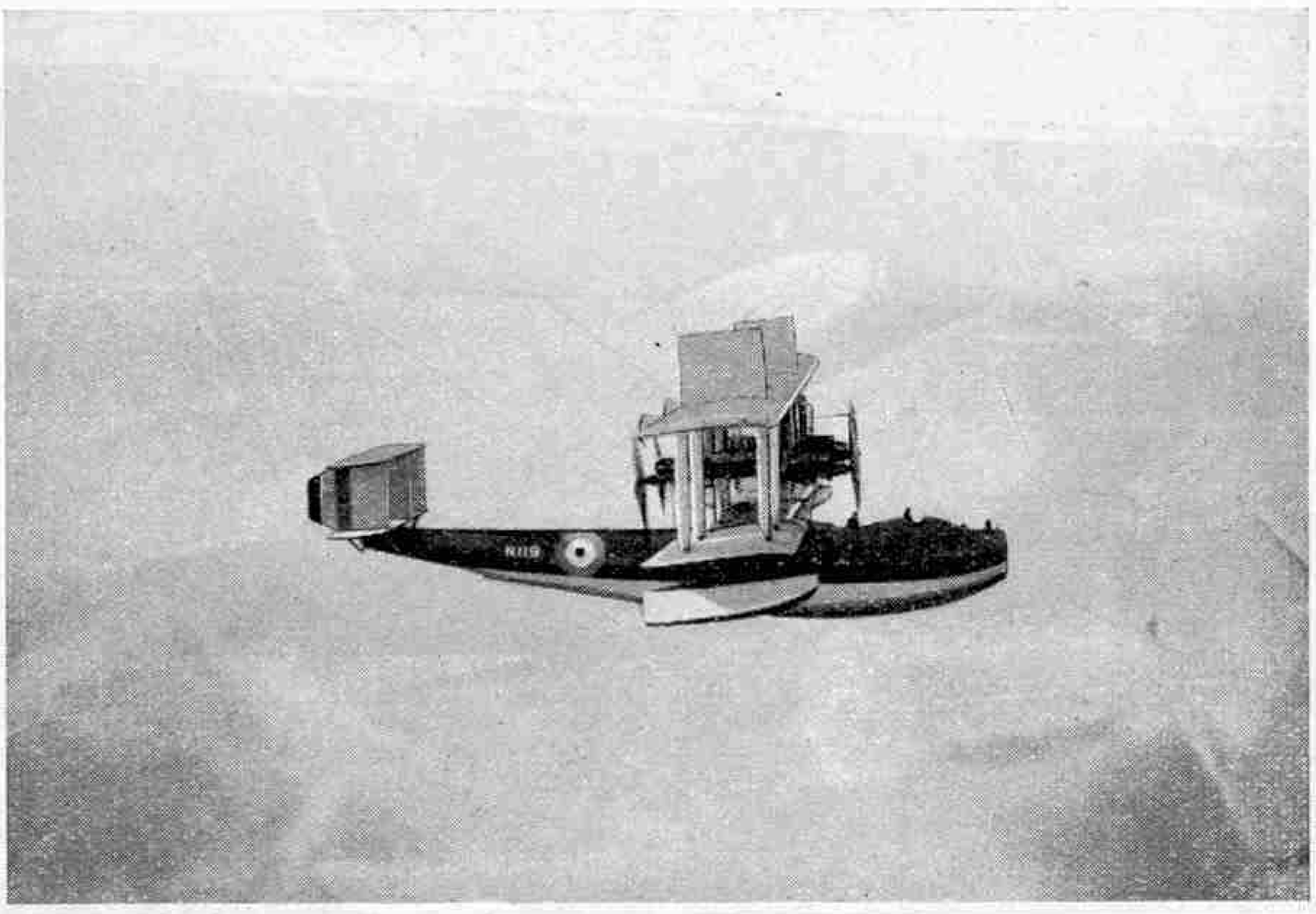
Any dynamo may be run as a motor by supplying it with current from another source. Consequently attempts have been made to substitute a single mechanism, known as a dynamotor, that combines the functions of a dynamo and a motor. These have been successful to a certain extent, but the combined machine may suffer from several disadvantages. To begin with, a dynamo for car purposes must be shunt wound, while a starting motor of the series wound type is best. A compromise is effected by making the dynamotor a compound wound machine. Further, the most suitable gear ratios in relation to the crankshaft of the engine are quite different for the two machines, and these differences lead to a loss of some of the efficiency of the separate components. It has been calculated that the efficiency of a dynamotor used as a generator is five per cent. less than that of a dynamo, and similarly its efficiency as a motor is reduced by two to three per cent.

A saving in weight and the elimination of one set of driving gear are the great advantages obtained by using a dynamotor. For small cars the combined mechanism is very suitable, and it will no doubt continue to be used on such vehicles in spite of the loss of efficiency.

An interesting development that has not attracted the attention it deserves from manufacturers is the use of a fly-wheel motor. It is quite easy to incorporate the starting motor with the fly-wheel by reversing the usual method of construction, and placing the magnets inside the armature instead of outside. In other words, the motor may be turned inside out. The rotating armature may then be made sufficiently heavy to act as the fly-wheel of the engine. A great reduction in weight is brought about by the amalgamation of two somewhat massive pieces of machinery, while there is the added advantage that no gearing is required, since the motor may be easily designed to run at fly-wheel speed.

An interesting point concerns the voltage of car lighting sets. These are usually of 12 or 6 volts. Contrary to the general belief, a 12-volt system is not necessarily more powerful than a 6-volt outfit. Power is concerned with current as well as voltage, and is measured in watts, or volt-amperes per second. A dynamo may be designed to give a larger current at six volts than a similar one working at 12 volts, and the amount of power obtainable from it may actually be greater.

When a 12-volt system is used the current required is only half that required in the case of a 6-volt system and smaller conductors may be used. Further, the magnitude of the resistance met with in the various circuits is of less importance. The advantages of a 6-volt system are that the accumulator is lighter and that the number of cells to be kept in order is less. In addition, shorter filaments may be used in the lamps. Such filaments are stronger and give a light source of smaller dimensions that makes focussing easier.



The Fairey "Atalanta" Boat Aeroplane, designed to operate with the Fleet as eyes to the battle squadrons of the Navy. It was provided with special gear capable of carrying tons of bombs and in every respect it constituted an important offensive unit of a particularly deadly character.
The "Atalanta" was 139 ft. between wing tips, and fully loaded weighed approximately 15 tons. It had a speed of 100 miles an hour and was fitted with three Condor engines as described on page 798.

ARE YOU IN DOUBT?

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Cable-Laying by Machinery—(*cont. from page* 787)

about 20 ft. behind the dredger with the loose earth by means of an adjustable aluminium chute which is plainly shown in the illustrations. The cable is rolled round a drum on the cable truck drawn behind the excavator and is conveyed on a series of rollers just behind the excavator buckets into the open trench so that there remains always a space of 13 to 16 ft. between the free part of the cable hanging into the trench and the refilled earth. The rollers that guide the cable on its way are suspended from the main conveyor arms.

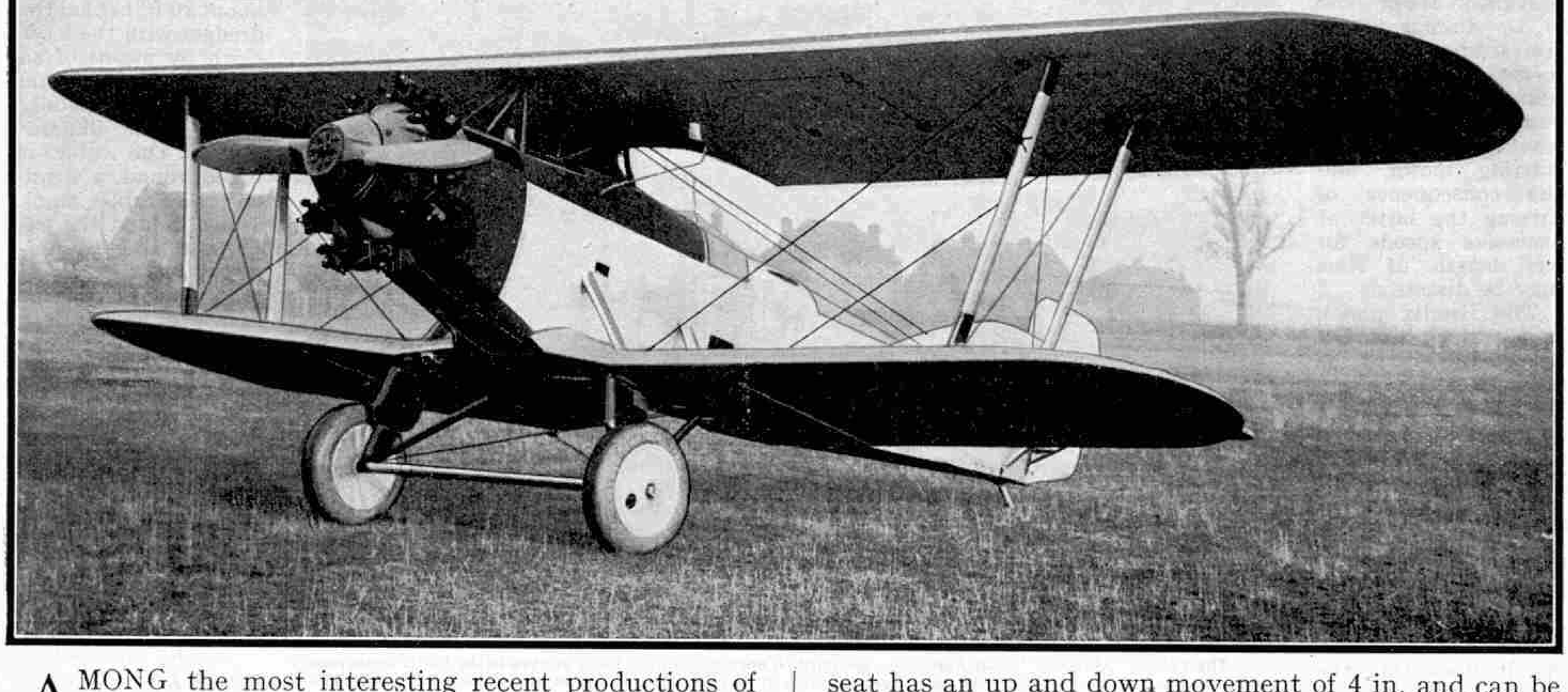
In trench excavators the direction of motion is usually changed by stopping one or other of the caterpillars. For managing the cable truck, however, the designers have adopted the plan of mounting the truck upon three caterpillars. The two rear caterpillars which carry the main weight are arranged at the sides but the third one in front of the truck is placed in the centre. This front caterpillar can be steered left or right, thus steering the whole vehicle. It is controlled by a handwheel with steering column from the driver's stand on the truck. Two brakes on the lateral rear caterpillars simplify the steering and they may be used also on steep slopes. The cable drum, which has a diameter of 82 ft. is operated from the driver's seat by means of a handle.

The procedure of laying a cable by this machine is as follows. First the excavator advances slowly digging the trench about 20 ft. in length until the cable truck reaches the trench. During this first operation the excavated earth is delivered on to the conveyor. A length of cable is then paid off the drum and led over the guiding rollers and laid in the trench just behind the excavator buckets. The excavator then moves on and earth is delivered through the chute into the trench thus covering up the cable. Subsequently the trench is completely filled in and last of all the central caterpillar on the trailer moving over the filled in trench rolls the earth level.

The laying of a cable by means of the above machine requires the service of only five men whereas to lay the same cable by hand would necessitate the employment of 150 men.

The Gloster "Goring" Seaplane

An Interesting Type of Long-Distance Bomber



AMONG the most interesting recent productions of the Gloster Aircraft Company is the Gloster "Goring" Seaplane. This machine is a single-engined biplane with a Bristol radial air-cooled engine and is designed primarily for long-distance bombing.

The "Goring" accommodates a crew of two, the pilot and a bomber. The bomber is provided with two stations, one immediately behind the pilot, from which point he can defend his machine with a gun mounted on a rotating turret, and the other beneath the pilot, from which point he sights and discharges his bombs. Both these positions allow of close communication at all times with the pilot.

The above illustration, by courtesy of the Gloster Aircraft Co., shows the "Goring" Seaplane as a land machine. The difference in size between the lower and the upper wings is clearly seen, and the roominess of the body is also evident

The floats are made entirely of duralumin and in design and structure are similar to those used on the Gloster racing machines. The whole of the surface of these floats is specially treated in order to prevent corrosion, and from experience of previous types it is anticipated that with ordinary care they should last a very considerable number of years.

The wings are of the single bay type with inverted "Vee" struts connecting the top wing to the fuselage. The span of the upper wing is 42 ft., the bottom wing being considerably smaller, and together they have a total area of 450 sq. ft.

The body is roomy, ample space being provided for cameras, wireless apparatus, bomb gear and the various fitments required for long-distance navigation. Both the pilot's and the observer's seats are of special design. The pilot's seat is of aluminium alloy, mounted on the rear ends of two horizontal beams that are pivoted at their forward ends to the sides of the fuselage. The seat has an up and down movement of 4 in. and can be operated easily during flight. The observer's seat is a built-up flat wood panel with rollers at each end engaging in channels fixed to the sides of the fuselage. This seat is held in its lower position by a bolt which, when released, allows the seat to be shot into a concealed position out of the way of the observer, thus allowing him full freedom of movement for fighting. Two generators are provided, one for the wireless and the other for lighting and heating.

Special consideration has been given to all controls. The ailerons, which are fitted to the top wings only, are mounted on ball bearings to eliminate any possible binding due to spar deflections, and are controlled through a specially devised differential gear contained entirely within the wing. There are no levers or other obstructions to detract from the efficiency of the aerofoil sections.

The ailerons and elevators are operated through the conventional joystick, which is very short and is pivoted to the elevator cross-shaft by a compact universal joint designed so as not to obstruct the bomber when in the prone position below the pilot. The rudder control is of novel design. Instead of the usual rudder bar, stirrups are provided for the feet to rest in, each stirrup being slidably mounted on a pair of steel tubes placed fore and aft along each side of the fuselage. There is nothing between the feet, so that the pilot has an unobstructed view of the bomber. The tail unit consists of the usual monoplane tail, twin elevators and balanced rudder. Special attention has been given to the elimination of all possible obstructions that might cause drag

and interference, thereby keeping the controlling surfaces as effective as possible.

Another special feature is the control wires. All these are swaged rods, cables having been superseded entirely except for a short length between the top wing and the aileron control gear inside the cockpit, where the wire might be exposed to accidental damage. Most of the wires run direct without fairleads, but where a definite bend is required in the aileron wires a chain and sprocket is used.

The aeroplane, when fitted with an ordinary Bristol "Jupiter" engine, has the remarkable speed range of from 40 to 140 m.p.h. When fitted with a supercharged engine, it is expected that a speed of 165 m.p.h. will be attained.

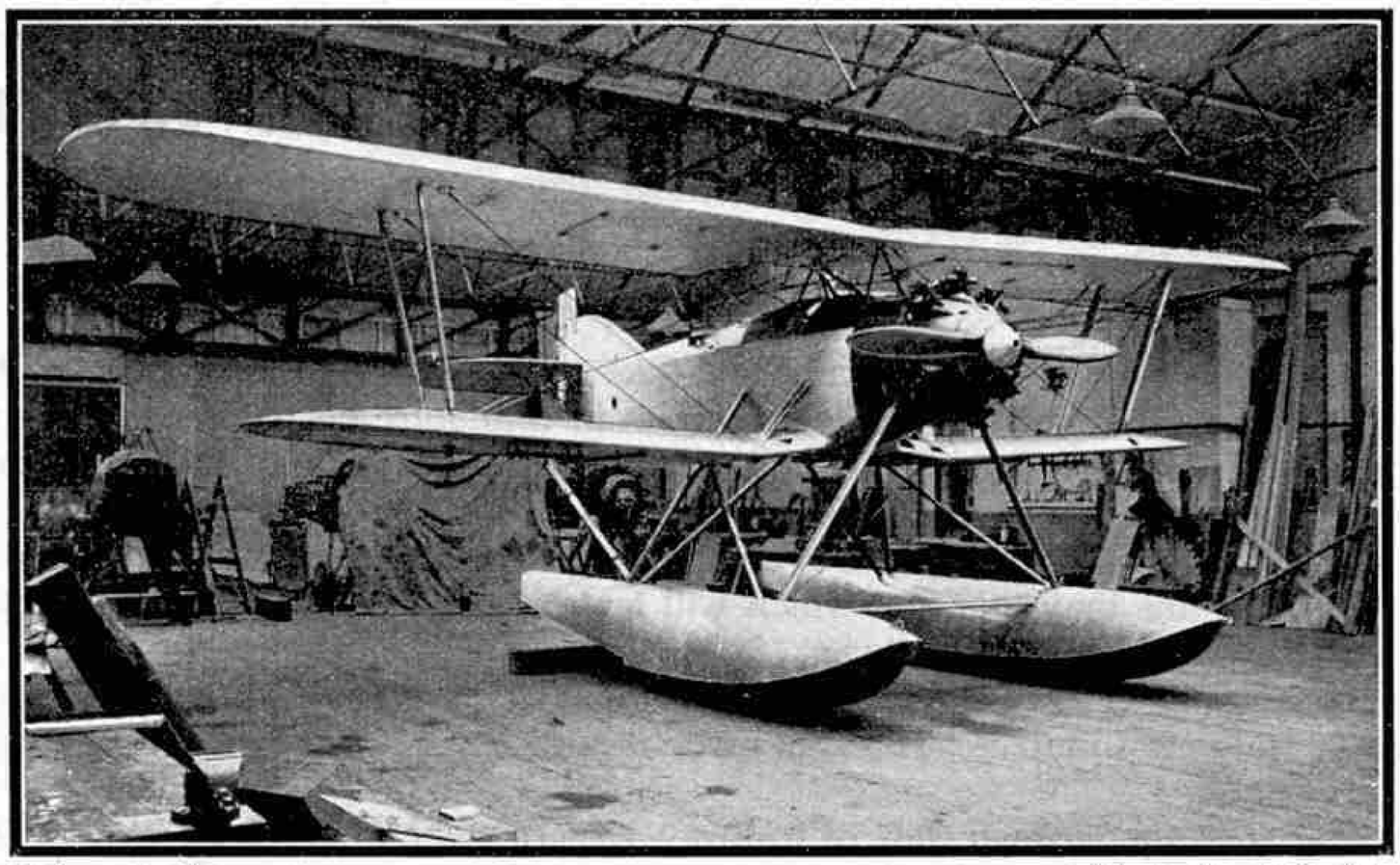


Photo courtesy] [*Gloster Aircraft Co. Ltd.*

Front view of the Gloster "Goring" Seaplane ready to leave the factory

Preliminary testing of the machine has been carried out with a standard type wooden airscrew, but a Gloster Hele-Shaw variable-pitch metal propeller will shortly be fitted to improve the performance still further.

Advantage is taken of the thick wing section to accommodate the petrol tanks entirely within the wings. There are two tanks, one in each top wing, of 75 gallons capacity each.

As a land machine the weight of the "Goring" is 2,800 lb. empty and 5,650 lb. fully loaded, including 150 gallons of petrol. As a seaplane its weight empty is 3,200 lb. and it carries a useful load of 2,450 lb. The land and the seaplane undercarriages are interchangeable to facilitate operations from either a land or sea-going base.

Famous Aero Engines—(*continued from page* 800)

metal Blackburn "Iris," the wooden-hulled Saunders "Valkyrie" and the all-metal Short "Singapore." The last-named was fitted with two "Condors," while the other machines had each three engines of the type.

The cruise commenced at Felixstowe and took in the capitals of Norway, Sweden, Denmark and Finland, while other stops were made at various ports on the shores of the Baltic Sea. The squadron covered a distance of 3,850 sea miles, the longest non-stop stage being 720 miles. In this connection it may be noted that on the return flight the "Singapore" was not refuelled from the time it left Helsingfors in Finland until after Copenhagen was reached.

Bad weather was the rule throughout the cruise, and often when they alighted the boats had to ride on rough water—not long swells, but the far more trying choppy broken sea! In spite of the tremendous buffeting and vibration involved, the cruise was a complete success.

"Condors" figured also in the now famous survey flight round Africa undertaken by Sir Alan Cobham. The huge all-metal Short "Singapore" used was fitted with two of these engines and successfully carried six persons on a flight of more than 20,000 miles. Trouble due to stormy conditions caused some delay at the Maltese anchorage, but the engines never gave a moment's anxiety. Purely as a matter of precaution they were overhauled at Durban, from which place Sir Alan cabled home his appreciation of their performance in 150 hours of flying in the varying climatic conditions encountered. The greater part of the flight was made at a temperature that rendered efficient cooling a matter of great difficulty.

On the return journey thick fogs and constant southerly winds were encountered while traversing the deserts that fringe the western shore of Africa for 500 miles to the north of Capetown, but neither these conditions nor those met with on the coast of tropical West Africa affected the engines. After a short overhaul, in fact, the machine carried out a highly successful flight round Britain.

Sir Alan's flight round Africa was not perhaps as spectacular an achievement as a flight across the Atlantic Ocean or the Pacific would have been. Long distance flights of that kind are undoubtedly of value in the development of fast aeroplanes and reliable engines, but at the present moment the exploration of air lines and trade routes that may become practical almost immediately is at least of equal importance.

In considering the achievements of aeroplanes fitted with "Condors" it must also be remembered that the engine was designed originally as a reliable power unit for use on large sea-going military aircraft. The flights to which we have referred, together with many others made by aeroplanes of various makes that have been fitted with "Condors," have demonstrated the extreme reliability of the engine under even the most trying conditions. It is all the more interesting, therefore, to note that the "Condor" compares very favourably for power production with famous racing engines of similar weight and nominal horse power. By omitting the standard reduction gear and compressing the engine into a more compact form it would be easy to transform it into a highly successful racing engine.

London's Post Office Tube Railway—

(*Continued from page* 815)

system to the other is effected by means of a switch on the station platform, under the supervision of the station foreman. The lifts convey letter traffic in an upward direction and parcels traffic both up and down.

A complete system of ventilation has been installed at each station, and in order to provide efficient ventilation for the machinery under the station platforms the fresh air is delivered through ducts just below the floor of the basement. From these ducts the air is distributed so as to give the necessary circulation round the plant and batteries. Air is extracted by separate circular iron ducts supported from the top of the station roofs and the discharge is taken up one of the shafts. To avoid any possible draught up the shafts or stairways the volume of air extracted is in excess of the delivery.

This automatic railway is the first of its kind in the world and it has been estimated that its use relieves London's surface street traffic to the extent of 1,300 van-miles per day, while the time taken to deliver mail from a terminal station to other points on the route has been reduced by approximately 18 minutes.

During the period since the inauguration of the system on 13th December last year to 8th March last, 3,576,000 ton-miles were run during 87 working days. At present 53,000 car-miles per week are being run on less than full service. The railway is in operation 21 hours out of each 24 for six days per week.

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Boy Directors

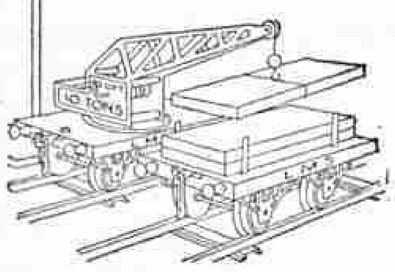
To be Formed by Readers of the Meccano

Hundreds of thousands of boys own Hornby Trains and take pride in the possession of them, but very large numbers of these boys do not really know how to run a railway system in miniature on correct lines. It has always been our wish that a boy who possesses a Hornby Train shall obtain 100 per cent. fun from his hobby but the difficulty has always been—how can we make our wish come true? We have pondered over this problem for years and we believe that at last we have solved it. The solution is the formation of an organisation to be known as the "Hornby Railway Company," which all owners of Hornby Trains may join and which will look after their interests and enable them to get the best fun possible from their Hornby miniature railway.

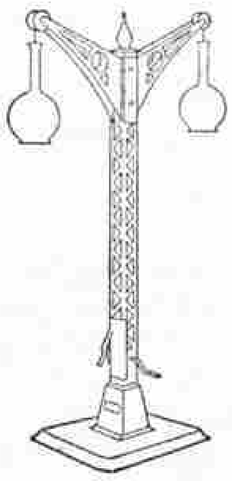
The founder and chairman of the "Hornby Railway Company" is Mr. Frank Hornby, the inventor of Meccano and Managing Director of Meccano Limited. This fact alone is sufficient to commend the new scheme to the affections of all Hornby train enthusiasts.

Mr. Hornby will be assisted by our own staff of Railway Experts, who are trained men of long experience, full of enthusiasm for their subject and keen to make the new venture a brilliant success. They will fill the executive offices at Headquarters and guide the affairs of the many Associated Branches of the "Hornby Railway Company" in local centres, which will be run by boy officials.

Any owner of a Hornby Train Set, no matter what its size, may become a member. All he has to do is to fill in the official application form for a share of fun and pleasure, have his signature witnessed, and send the form to Headquarters with 6d. in stamps in payment for the official badge, which he will wear in his buttonhole. This badge, which is illustrated in the top corners of these pages, is beautifully finished in red and green enamel and bears a representation of a locomotive surrounded with the words "HORNBY RAILWAY COMPANY." By means of this badge all members will be able to recognise each other when they meet. Their badges will indicate at once that they have something in common—an interest in railways—and we are certain that, after a hearty handshake, conversation will never flag between any "HORNBY RAILWAY COMPANY" members who may meet in this manner! Whether in your own town, or at the seaside or in the country on holiday, always look out for the "H.R.C." badge.



Members in any town, village or district, will meet together to form a Local Branch of the "HORNBY RAILWAY COMPANY." In organising this they will consult the staff at Headquarters, an important part of whose work consists in encouraging and helping in a practical manner in the formation of such branches. Each Local Branch will be controlled by the members themselves, who will appoint from among their number their own General Manager, Engineer, Traffic Superintendent, Stationmasters, Signalmen, Drivers, and any other officials that may be considered necessary for the adequate operation of the Branch.



When a Local Branch has a membership of not less than six, in addition to a permanent Branch Chairman and a Branch Secretary elected by a vote of the members, and is holding regular meetings, application may be made for incorporation with the parent company. Every incorporated company will be supplied with all the necessary instructions for operating a miniature railway system and will be given advice regarding the best means of extracting the utmost fun from the material at its disposal. All the necessary forms and documents—miniatures of those used by the big railway companies—may be purchased at a small cost, and their use will add enormously to the fun and excitement of operating the railway.

The details of each Local Branch will be left entirely in the hands of members. Headquarters will not interfere in any way with such matters as the time

UNCING
AILWAY COMPANY
RY TOWN AND VILLAGE

THIS BADGE IS ENAMELLED IN COLOURS AND WILL BE WORN BY MEMBERS OF THE HORNBY RAILWAY COMPANY

to Magazine and Owners of Hornby Trains

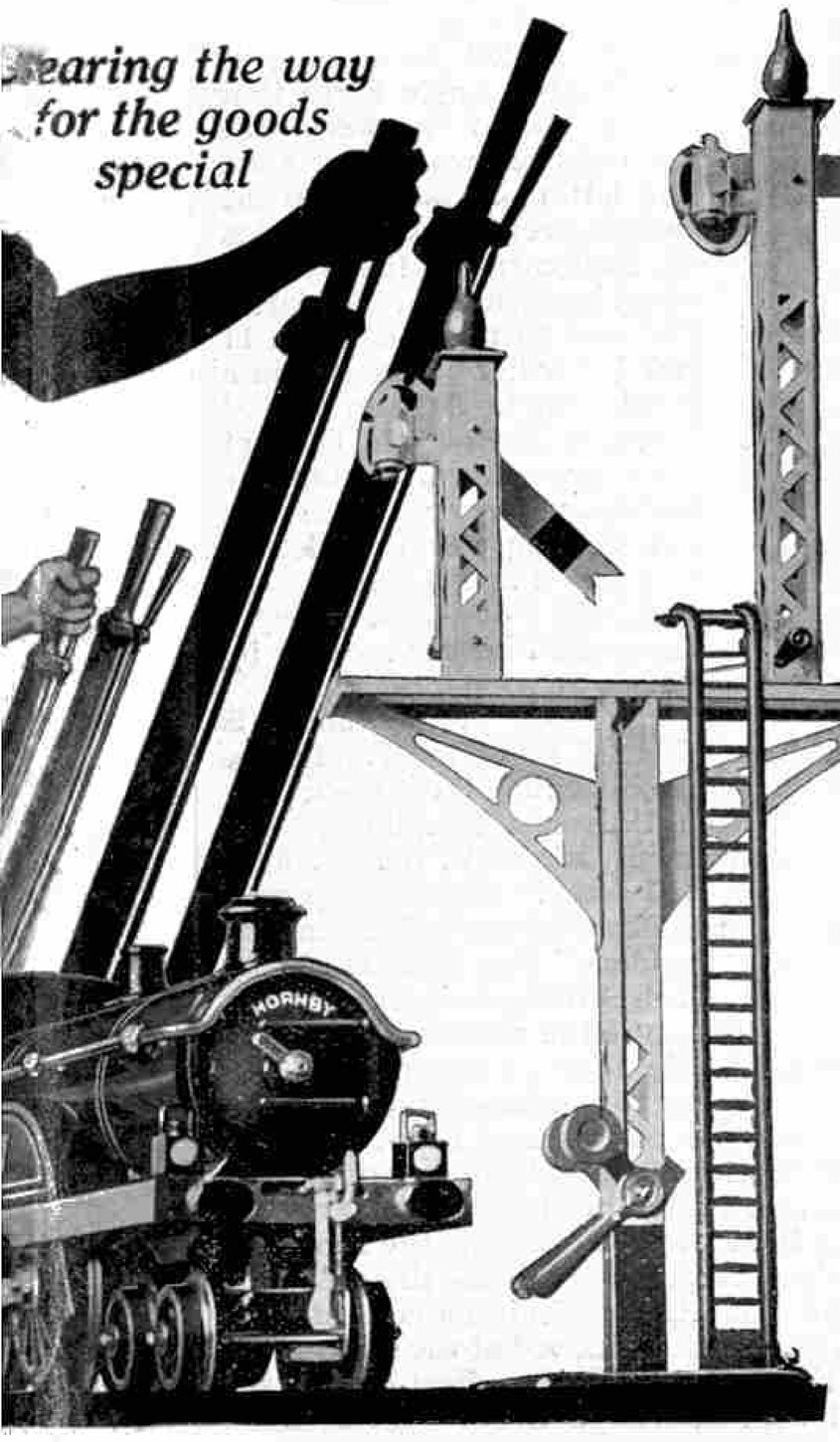
Boy Officials

At the back of this organisation stand the four Railway Groups of the United Kingdom, all of whom have entered into the spirit of the "Hornby Railway Company" venture and already have supplied us with much intimate railway information. They have given our officials access to their offices, works, engine sheds and signal cabins, and they have even offered us footplate trips on their most famous expresses. They are as keen as we are that the Hornby Railway Company shall be run exactly on the same lines as a real Railway Company and they are glad to help us and our young friends to the utmost extent possible. They have told us everything there is to be known about modern railway practice and have furnished us with the printed forms that they themselves use in their regular everyday work. These forms, or such of them as are necessary to the correct working of a miniature railway, are being reproduced by us in miniature and will be available for the use of members.

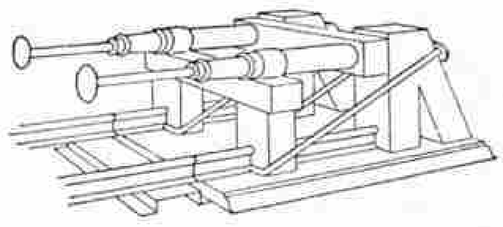
The "Hornby Railway Company" will have its Headquarters in Binns Road, Liverpool, where a complete railway system has been installed for experimental and test purposes. There will be a Company Secretary, whose duty it will be to correspond with the officials of associated Hornby Railway Companies throughout the country, and to assist them in their work. In addition there will be other officials to act in various departmental and advisory capacities.

The one object of this great organisation and all its officials will be to ensure that every Hornby Train user in the world is obtaining every possible ounce of fun from his hobby.

and place of meeting, the subscription, or the rules that may be considered advisable for the successful working of the Branch. In addition, it is a matter for the consideration of each individual Branch as to whether it shall purchase material for the general use of its members, or whether members shall combine their own material to form a basis of the layouts, supplementing this from time to time by additions purchased out of Branch funds.

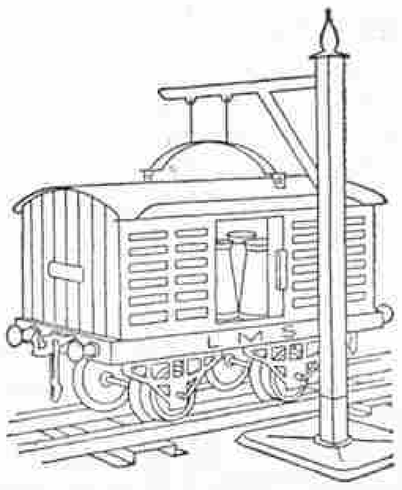


The duty of the Branch Chairman will be to supervise the general organisation and operation of the branch and to do his utmost to assist the members to secure the best possible results. The duty of the Branch Secretary will be to communicate with the members of the Branch in regard to meetings and any other matters that may arise from time to time, and to forward to Headquarters on the first of each month a record of the operations of the Branch during that month, for which purpose special forms will be provided by Headquarters.

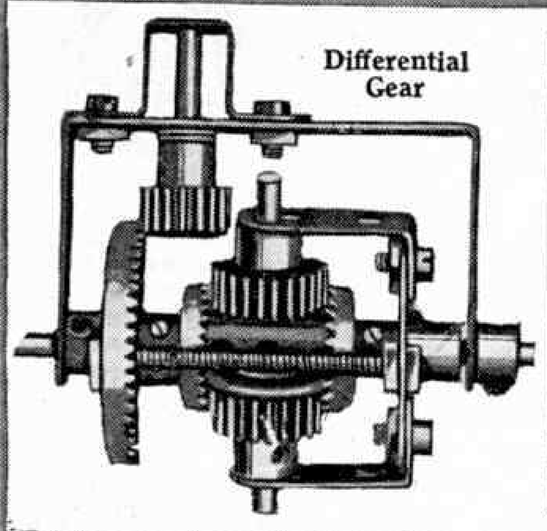


The official organ of the "HORNBY RAILWAY COMPANY" is the "*Meccano Magazine*," which, as our readers know, has always devoted considerable space to model railway matters. In future a special section of the magazine will be devoted entirely to the "HORNBY RAILWAY COMPANY" and brief reports will be given of the progress of each affiliated Branch with special reference to any developments of unusual interest, so that each Branch will be able to benefit by the experience of every other Branch. In addition, month by month will appear articles on miniature railway working in all its aspects. Layouts will be illustrated and described in detail with suggestions for their modification in case of need to suit special circumstances.

A booklet is now in course of preparation dealing in detail with the "HORNBY RAILWAY COMPANY," its organisation and objects, and showing exactly how a Branch Company may be started and carried on successfully. In addition the booklet contains a great amount of information on the running of a miniature railway. It enumerates the officials that are necessary and describes in full their duties. Timetable working also is dealt with and full instructions are given for the preparation of a working timetable for any layout.



This booklet will be sent from Headquarters to applicants on receipt of 2d. in stamps. Orders will be accepted now and will be dealt with in rotation as soon as the booklet is published. They will not be acknowledged, but every applicant may rest assured that the booklet will be sent to him at the earliest possible moment.



Suggestions Section

Edited by "Spanner"

(136)—Demonstration Model of Brown Steam Tiller

IN the case of small sailing boats, etc., a hand-operated steering gear is all that is required, but in the larger mechanically-propelled ships extremely powerful engines frequently are required not only to move the rudder when changing course, but to return it to its original position whenever it is deflected by external forces such as heavy waves, etc. There are several forms of power-operated steering gears in use, driven as a rule by steam or electricity. Each one incorporates some form of "hunting gear" by means of which the position of the rudder may be maintained exactly in agreement with the position of the steering wheel. A typical hunting gear reproduced in Meccano was described in the December, 1926, "*M.M.*"

One of the most interesting types of ship's steering gear is the Brown steam tiller that forms the subject of the Meccano model shown in Fig. 136. In the model the mechanism is actuated by a Meccano 4-volt Electric Motor, but in the prototype a steam engine forms the source of power.

The operating unit revolves about a Ball Bearing 1 (part No. 168), the Motor being connected to the upper Ball Race by means of 2½" Angle Girders, which are attached to the Race by bolts passed through their centre holes and are secured to the switch end of the Motor by ½" × ½" Angle Brackets. The lower or fixed Ball Race is bolted rigidly to a 4½" Angle Girder that is secured, in turn, to the top 12½" Girders of the demonstration frame.

A 2½" × 2½" Flat Plate is bolted to the flanges of the Motor and two 4½" Angle Girders 2 are attached to the Plate by 1" × 1" Angle Brackets. Two 2½" Angle Girders are bolted to the opposite side of the Motor and a 3" Strip is secured across their top ends. The protruding end of this Strip and that of a 1½" Strip bolted to the 2½" × 2½" Flat Plate together form bearings for a 3" Rod 3. This Rod 3 carries a ½" Pinion, which is in engagement with a Worm on the armature spindle of the Motor, and also a ½" fast Pulley that is connected to a 1" fast Pulley 4 by a belt composed of a short length of Spring Cord.

The Pulley 4 is secured to a short Rod that is journalled in a Trunnion and also in the 2½" × 2½" Flat Plate bolted to the Motor. A ½" Pinion secured to the end of this Rod meshes with a 57-teeth Gear 5, which is loose on the 6½" Rod 6. A 1" fast Pulley 7—with a small Rubber Ring (part No. 155) round its periphery—is secured on the Rod 6 and the face of the Gear 5 is forced against the Rubber Ring on the Pulley 7 by means of a Compression Spring. The latter is placed on the Rod 6 and is retained in a slightly compressed state against the boss of the Gear by a Collar fastened to the Rod. The end of the Rod 6 carries a ½" Pin that meshes with the curved rack 13, which is composed of t o Rack Strips bolted together and secured to the frame in e manner shown.

The most interesting feature of the model is the manner in which the Motor switch is operated by the steering wheel, for in this lies the principle upon which the action of the prototype depends. Of course, it should be borne in mind that the switch arm represents the steam valve of the actual gear.

A Rack Segment 8 is bolted to the underside of the centre switch arm of the Motor and is spaced from the arm by two Washers on each of the two holding bolts. A ½" Pinion 9 meshes with the Rack Segment 8 and is secured to the 3" Rod 10 that carries a second ½" Pinion meshing with the Worm 11. The foot of the Rod 10 is journalled in two 2" and one 2½" Strip, the latter being bolted to the underside of the fixed Ball Race, and its upper end is journalled in a 1½" × ½" Double Angle Strip that is bolted between the ends of two Architraves. The latter are secured to the upright Sector Plates in which the Rod carrying the steering wheel is journalled. The latter Rod also carries the Worm 11 and is further journalled in a ½" × ½" Angle Bracket bolted to the Architrave, the Bracket being spaced away from the Architrave by two Washers. The steering wheel consists of a Face Plate, around the periphery of which eight Threaded Pins are secured by means of Angle Brackets.

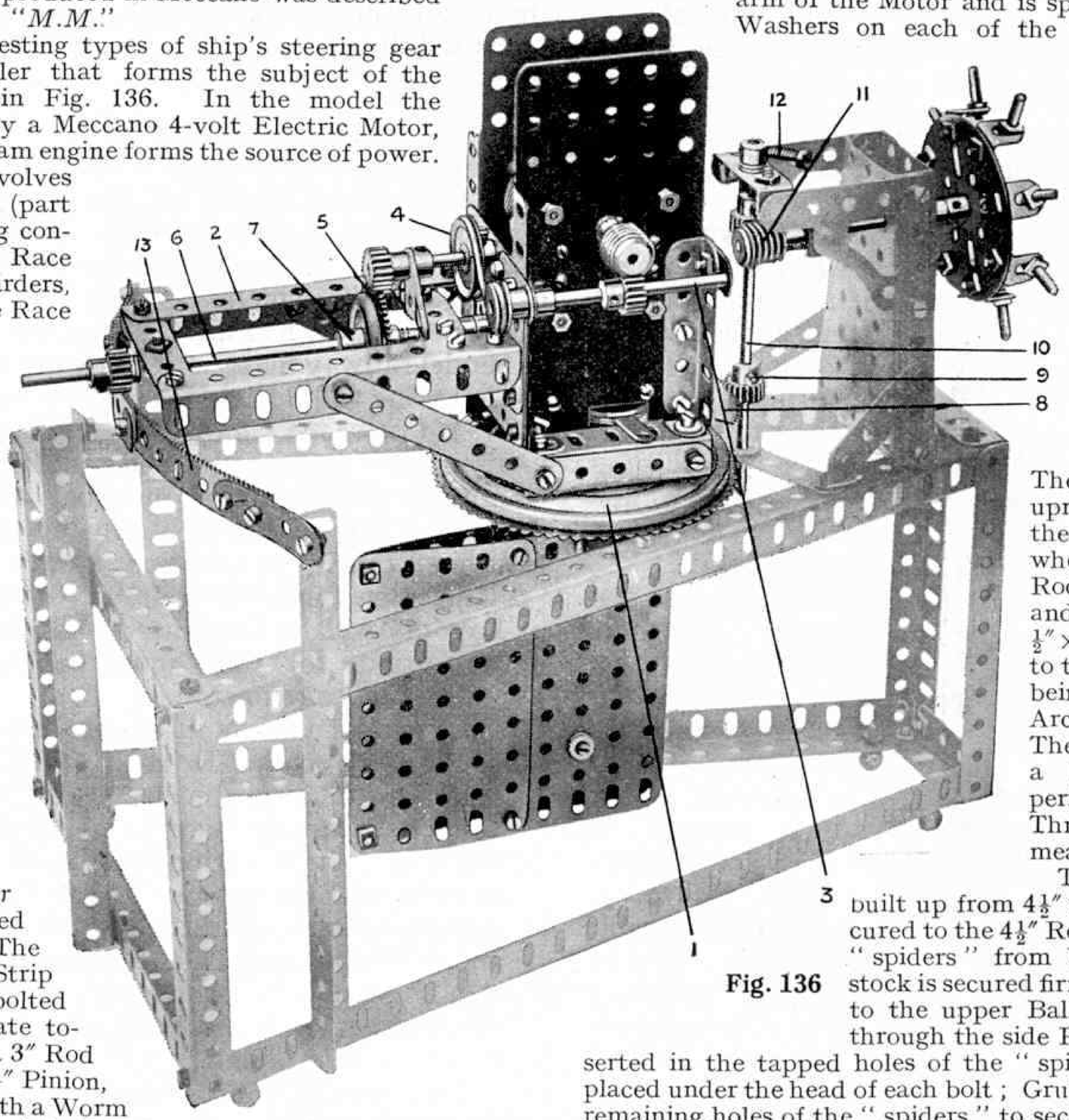


Fig. 136

The body of the rudder is built up from 4½" × 2½" Flat Plates and is secured to the 4½" Rod forming the "stock" by "spiders" from Universal Couplings. The stock is secured firmly in a Bush Wheel bolted to the upper Ball Race. Bolts are passed through the side Plates of the rudder and inserted in the tapped holes of the "spiders," two Washers being placed under the head of each bolt; Grub Screws are inserted in the remaining holes of the "spiders" to secure the rudder more firmly to the stock. It is an advantage to file a flat on the stock at the points where the screws grip it, in order to preclude any possibility of "slip" taking place between the rudder and tiller.

The operation of the steering gear is as follows. Suppose the steering wheel is moved to the right, then the Motor switch arm will move to the left, thus starting the Motor and causing the Pinion to move over the rack 13 to the right, carrying with it the tiller (i.e., the apparatus revolving upon the Ball Race). This movement continues for so long as the Rack Segment 8 is moved at the same speed as the tiller, but if the rotation of the steering wheel ceases, the Motor switch mechanism becomes stationary. The movement of the tiller, and hence the Motor, will (*Continued on next page, col.* 1)

(137)—Portable Lamp, with Automatic Switch

(H. Harriss, Birtley, Co. Durham)

The chief point of interest in the novel electric lamp illustrated in Fig. 137 is the fact that the bulb is illuminated immediately the lamp is picked up. As soon as it is put down again, out goes the light! This arrangement undoubtedly economises in the use of current, and incidentally it may afford a mild surprise for an uninitiated person when he first handles the lamp.

Fig. 137 is a view of the complete lamp with the Meccano 8 ampere-hour Accumulator in position, and Fig. 137a is a view from the rear with the Accumulator and two sides removed. The handle consists of a Wood Roller secured on a 4½″ Axle Rod by means of two Bush Wheels.

The automatic switch device comprises a 2½″ Rod 3 (Fig. 137a) journalled in one of the 3½″ × ½″ Double Angle Strips forming part of the base and also in a ½″ × ½″ Angle Bracket bolted to one of the side Plates. A second Angle Bracket 2 is attached to and insulated from the 3½″ × 2½″ Flanged Plate in the base by a 6 B.A. Nut and Bolt equipped with an Insulating Bush and Washer. A short length of wire is attached to this 6 B.A. Bolt to form a connection with one of the terminals of the Accumulator that supplies the current for the lamp. A Compression Spring is placed on the Rod 1 between the Angle Bracket and a Collar.

A 6 B.A. Bolt is inserted in the hole in the base of the Lamp Holder 1 (Fig. 137) so that its head is inside the latter. The shank of the Bolt is then passed through a hole in the 5½″ × 3½″ Flat Plate and an Insulating Bush is placed upon it. A 6 B.A. Nut, with a short length of wire clamped beneath it, retains the Lamp Holder in position; this wire is connected to the second terminal of the Accumulator. The latter is retained in position by three 3½″ × ½″ Double Angle Strips, which are secured to the side Plates by the bolts 4.

The Compression Spring normally holds the Collar in contact with the Angle Bracket 2, thus completing the circuit. As soon as the lamp is put down, the portion of the Rod 1 that projects beneath the base is forced upward out of contact with the Angle Bracket 2, thus stopping the flow of current to the lamp.

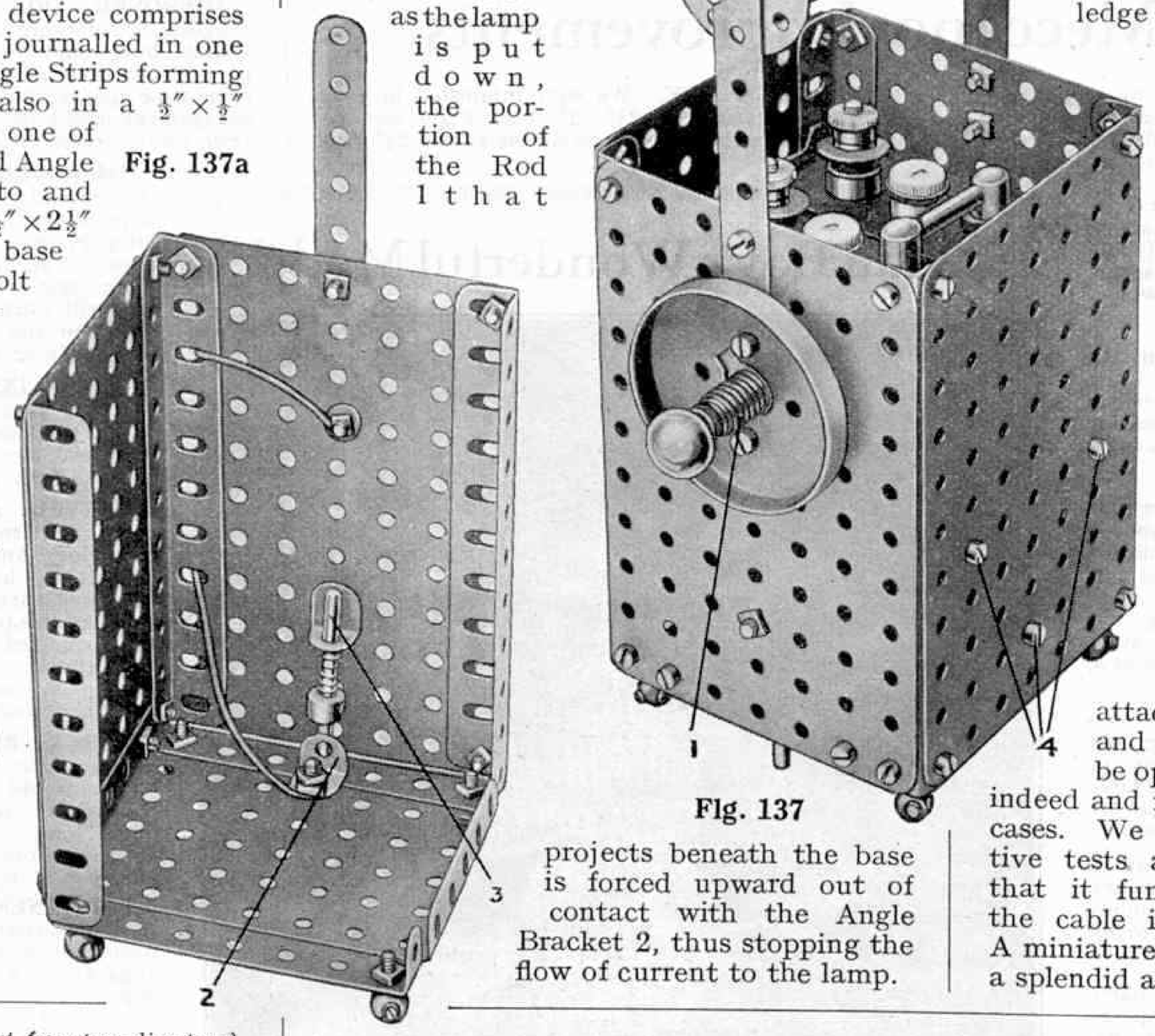


Fig. 137a

Fig. 137

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.26). Support for Sprocket Chain.—It must often have been the experience of model-builders to find that Sprocket Chain easily slips off the Sprockets when used in a horizontal plane. A. Slymn (Urmstone, Manchester) provides a solution of the problem by securing a Pulley or similar part immediately beneath each Sprocket. The Pulley should be larger in diameter than the Sprocket so that, protruding, it forms a ledge on which the Sprocket Chain is supported while passing round the teeth of the Sprocket. A 1½″ Pulley could be used in combination with a 1″ Sprocket, or a 2″ Pulley with a 1½″ Sprocket, and so on.

(M.27). Meccano Bowden Wire Control.—An entirely new use has been found for Spring Cord by B. Adams (Westcliff-on-Sea) and J. Anderson (Bedford) who use it as the outer case for a Bowden control wire. The two ends of the Spring Cord are restrained from moving by clamping them between Strips or in a Collar, etc., and a length of thin wire is passed through the centre of the Spring Cord, one end being attached to the operating lever and the other to the device to be operated. This idea is very good indeed and may be applied in innumerable cases. We have subjected it to exhaustive tests and can vouch for the fact that it functions correctly, even when the cable is taken round sharp bends. A miniature Bowden wire control makes a splendid addition to model motor cycles.

Steam Steering Tiller—*(cont. from preceding page)*

then have the effect of bringing the switch to the off position, when of course all movement ceases.

If the rudder is struck by a very heavy wave or other external force, the clutch formed by the rubber-shod Pulley 7 and the Gear 5 slips and allows the rudder, and with it the tiller, to move round. But this motion of the tiller closes the switch, and the Motor, starting up, promptly returns the tiller to its original position, so that the switch is once more at the "off" position. Hence, once the helm has been set, the rudder is maintained at the correct angle automatically.

It may be found when first the model is tried that the tiller turns *against* the rotation of the steering wheel instead of in the same direction. If this is the case the belt of Spring Cord should be crossed (as in the illustration), thus changing the direction of rotation of the ½″ Pinion engaging with the curved rack.

The stop 12 is to limit the movement of the Rod 10 so that the Pinion 9 may not turn the Rack Segment 8 too far in the "hard over" positions of the steering wheel. The ½″ Bolt secured in the Collar strikes against the shank of a bolt attached to the 1½″ × ½″ Double Angle Strip.

(138)—Map Measuring Instrument

(R. H. Daw, Pinner, Middx.)

Many of our readers who are enthusiastic cyclists must have felt the want of a simple means whereby they may ascertain distance correctly on a map. Of course, an approximate result may be arrived at by using a pair of dividers, but this method gives only the distance in a straight line between any two places and does not take into account the winding of the road. In Daw's model, however, it is only necessary to roll a wheel carefully along the route desired in the map to obtain a very close approximation of the actual distance.

The dial of the instrument is divided into forty equal parts representing inches, which when compared with the scale of the map will give the mileage. Thus, if the dial gives a reading of 10, and the scale of the map is ½ in. to the mile, the actual distance will be 20 miles.

The instrument consists essentially of a Bush Wheel 1 secured to a Rod that is journalled in the end holes of the two 5½″ Strips forming the frame of the model. On the same Rod is secured a ½″ Pinion that meshes with a 57-teeth Gear Wheel 2. The latter is carried on a Rod on which is a further ½″ Pinion meshing with another 57-teeth Gear on the dial shaft 3.

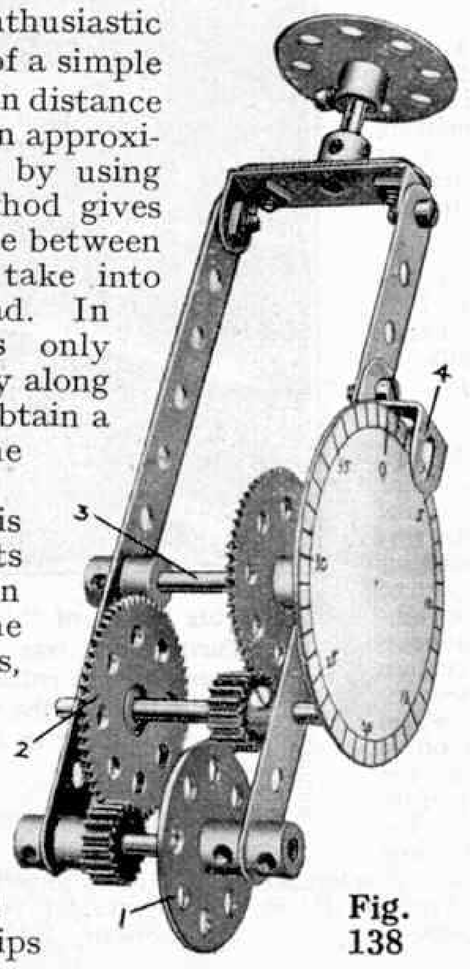
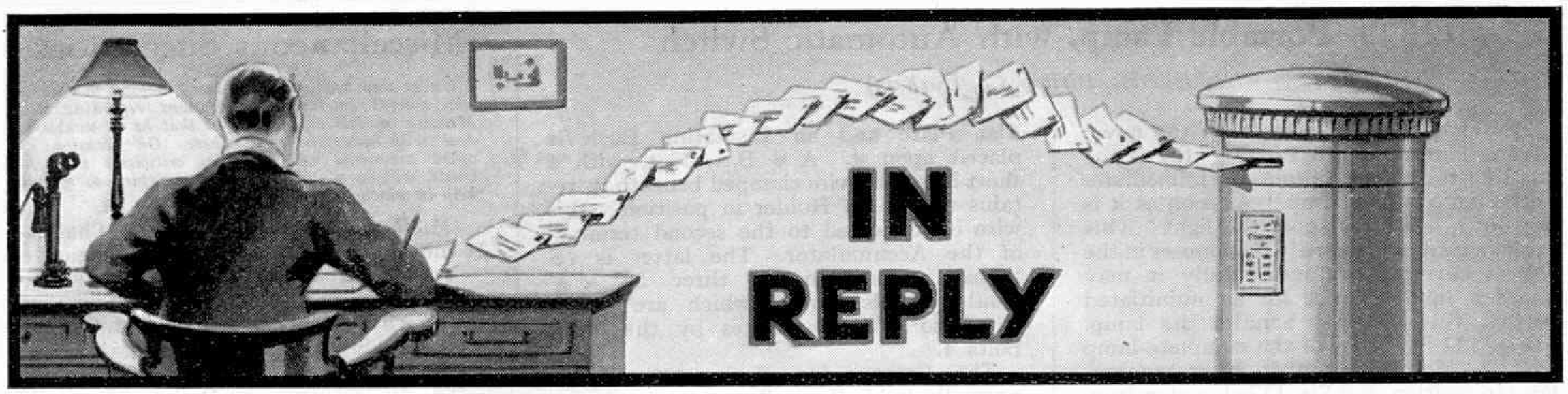


Fig. 138

The dial itself consists of a Face Plate on which is stuck a circular disc of white cardboard. The graduations on the dial are read through the slotted hole of the ½″ Reversed Angle Bracket 4.

The parts required to construct this instrument are:—

2 of No.	2	5 of No.	37
3 ,, ,,	17	1 ,, ,,	48
1 ,, ,,	18A	4 ,, ,,	59
2 ,, ,,	24	1 ,,	62B
2 ,, ,,	26	1 ,, ,,	109
2 ,, ,,	27A	1 ,, ,,	125



In these columns we reply to suggestions regarding improvements or additions to the Meccano and Hornby Train systems. We receive many hundreds of such suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on separate sheets of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Liverpool.

Suggested Meccano Improvements

BLUE PRINTS OF MODELS.—Your suggestion that blue prints of sections of the more complicated models should be published, aroused our interest considerably. However, we doubt whether the idea is really practicable. The sectional illustrations in the leaflets and in the Manuals of Instruction make matters much more clear than an entire set of blue prints would do, at least to those unaccustomed to reading mechanical drawings. (*Reply to L. Gilbert, Croydon*).

IMPROVED FAN.—A reduction in the number of blades fitted to the Fan (part No. 157) would no doubt add to the realism of this article. We are filing your idea for further consideration. (*Reply to J. Bruxmer-Randall, Cheltenham*).

MECCANO DIARY.—While we are unable to say at present whether a special diary for Meccano boys will be published for 1929, we are giving attention to this suggestion, as there is evidently a considerable number of model-building enthusiasts who would welcome a publication of this kind. (*Reply to L. Fernwort h, Scotstoun, Glasgow*).

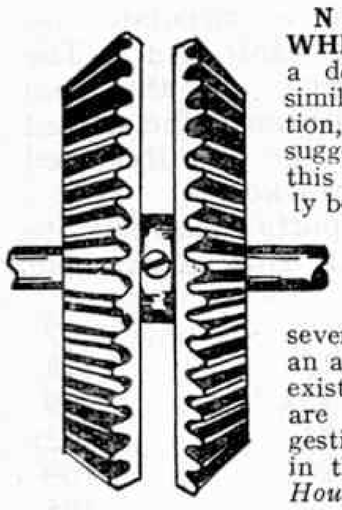
CORRUGATED PLATES.—Special corrugated plates to be used as roofs, etc., for models are hardly suitable additions to the system. We find the standard Plates quite effective as a roofing material. (*Reply to L. M. Noguera, Buenos Aires, Argentine*).

IMPROVED CRANK.—To fit square bosses to the existing Cranks is unnecessary as the boss will not slip in the Crank unless an abnormal strain is placed upon it. (*Reply to W. Dickson Gammell, Glasgow, N.W.*).

WHEEL DISCS.—While these parts would prove of use in giving a neat appearance to the wheels of model motors, we could not consider introducing them for this reason alone. Perhaps readers could suggest further uses for a conical disc? (*Reply to T. White, Streatham, S.W.*16, *and E. C. Collins, Newbury, Berks.*).

12 : 1 RATIO.—We agree that a gear ratio of 12 : 1 is a very necessary addition. (At present it is impossible to obtain a ratio of 12 : 1 unless a gear train consisting of a number of existing Gear Wheels, is employed). We will consider introducing gear wheels giving this ratio in the future. (*Reply to S. F. Nicholls, Wrexham*).

5½″×5½″ FLAT PLATE.—It is not, we consider, advisable to introduce a Flat Plate of this size to the system as existing parts can be adapted quite easily to form your suggested article. (*Reply to A. Helliwell, Bradford*).



NEW BEVEL WHEEL.—We consider a double bevel wheel similar to the illustration, a very interesting suggestion. A wheel of this type would certainly be an aid to compactness in certain Meccano mechanisms. The wheel of course, offers several advantages over an article built up from existing parts. We are keeping this suggestion before us for reference in the future. (*Reply to P. R. Houston, Nottingham*).

NEW FLAT PLATE.—We were interested in your suggestion regarding a 2½″×2″ Flat Plate but do not consider its introduction advisable as two 2½″ Flat Girders joined side by side will form an effective substitute for your suggested part. (*Reply to L. King, London, S.E.*1).

IMPROVED DOG CLUTCH.—We note your suggestion regarding an improvement to the Dog Clutch, but would point out to you that the edges of both portions of the Dog Clutch were rounded some time ago, so that smoother engagement and disengagement might be effected. (*Reply to W. L. Holcroft, East London, South Africa*).

IMPROVED CLOCKWORK MOTOR.—To extend the winding spindle on both sides of the Clockwork Motor would certainly simplify the winding of the Motor in certain cases. This improvement has been effected in the case of the Electric Motor and no doubt we will introduce your suggested improvement in the near future. (*Reply to R. J. Jones, Ipswich*).

NEW INSTRUCTION MANUAL.—In reply to your query we are pleased to say that a combined Manual of Instructions and Standard Mechanisms will shortly be available. (*Reply to D. Healey, Sheffield*).

CURVED ANGLE GIRDER.—We continue to receive numerous suggestions regarding Angle Girders but up to the present we have not found sufficient uses for these parts to justify their introduction. Readers' ideas regarding the uses to which the suggested part could be put, would be appreciated. (*Reply to N. K. Mantle, Rhyl; S. and M. Falkof, Johannesburg, S. Africa, and others*).

LARGE BRACED GIRDERS.—We do not see that extra long lengths of Braced Girder would be of any real advantage to the system, as it is quite a simple matter when long lengths are required to build them up from a number of existing Girders. (*Reply to C. R. Cranston, Swansea, S. Wales*).

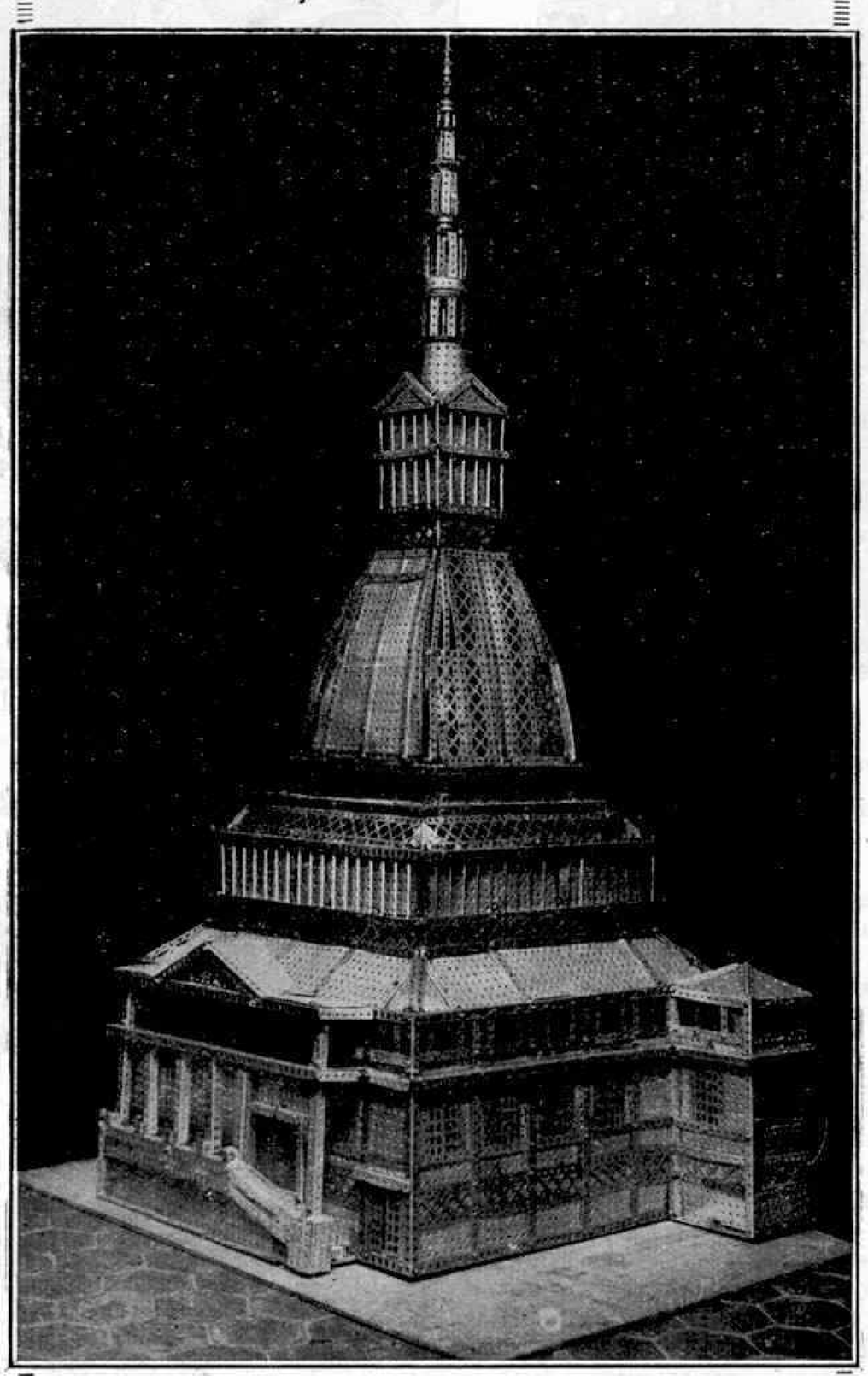
PERMANENT MAGNETS.—While we agree that the introduction of permanent magnets would considerably simplify certain electrical apparatus, an electro magnet such as the one described on page 245 of the March issue of the "*M.M.*" can be used in nearly every case in place of your suggested permanent magnet. Where alternating current is used, however, such mechanisms as magneto bells, etc., can only be constructed with the aid of permanent magnets, and for this reason we will give further thought to your suggestion. (*Reply to L. B. Baker, Redditch*).

WINDSCREENS.—We fail to see that small windscreens for attachment to model cars would form suitable additions to the system. We continually receive particulars of model automobiles in which the builder has utilised small pieces of celluloid in conjunction with Meccano parts to form the windscreen of his model car. (*Reply to F. Lilly, Langside, Glasgow*).

FLAT SPRINGS.—We regret to say that special flat springs are not suitable for inclusion in the system. A piece of flat spring, 1½″ long, is used in the Meccano Clock, but other uses for such an article could not easily be found. (*Reply to F. R. Cromer, Rugby*).

SPECIAL NUTS.—We have inspected your drawings of a new type of nut very carefully, but we are not quite clear as to exactly how it could be used in the Meccano system. Apparently the nut is to have a series of slots in one of its faces, and special split pins are to be used to lock the nuts on to the Bolts or Screwed Rod. This method of fastening nuts to screws, although adopted in certain mechanisms, is entirely unsuitable for use in the Meccano system, as it would necessitate perforating the various bolts, etc., with a number of holes. We would be pleased, however, to receive your further comments on the idea when no doubt you will be able to inform us more clearly of the exact advantages your suggested part would offer. (*Reply to F. Thornton-Jones, Manchester*).

Italian Boy's Wonderful Model



This model of "La Mole Antonelliana," a huge monument in Turin, Italy, was constructed entirely from Meccano parts by a young Italian enthusiast, Francesco Cavallari Murat. The model was entered in the "March" Model-building Contest and secured the First Prize in the "Overseas" Section (see page 841 of this issue).

Suggested Hornby Train Improvements

LONGER HORNBY STATIONS.—We agree that the present type of Hornby Station is comparatively small to scale. There are certain difficulties, however, in the way of producing a station that would be large enough to meet your requirements, and we think that after a little consideration you will agree that such a station would be so large as to be unwieldy. (*Reply to John Jamieson, Bletchley*).

VACUUM BRAKE PIPES.—We are now designing new vacuum brake pipes and we hope to make a further announcement in the near future. (*Reply to D. H. Heaps, Hastings*).

STORES TRAINS.—We doubt whether a set of this kind would prove popular. In any case the component parts can be purchased separately if required. (*Reply to Ron Murray, Auckland, N.Z.*).

CONTROL LEVEL CROSSINGS.—Crossings of this type would certainly be interesting and would add to the attractiveness of a layout. We shall give this idea careful consideration. (*Reply to Dennis Lewis, London, W.*10).

GOODS WAREHOUSE.—We hope to introduce a model of a goods warehouse shortly. No details are available at the moment but an announcement will be made before long. (*Reply to T. Anthony, Crossmyloof, Glasgow*).

4-4-2 TANK ENGINES.—Your idea is quite good and will be carefully considered. It appears to us, however, that there would not be any great demand for an engine of this type, as it would be very similar to our present 4-4-4 No. 2 Tank Engine. (*Reply to Stewart Bowis, Brighton and John Wright, Delph, near Oldham*).

ELECTRIFICATION OF No. 1 AND No. 2 LOCOMOTIVES.—We are experimenting with locomotives of this kind fitted with electric motor and the results will be announced in these pages as early as possible. (*Reply to C. W. Collins, Christchurch, N.Z.*).

HORSE BOXES.—You will be interested to hear that we have now practically completed designs for a horse-box. We are afraid that this will not be in production until next year however. (*Reply to H. C. Newton, Pontefract, and L. Livingstone, Learmouth, Kingswood, Surrey*).

MINIATURE SACKS.—We already manufacture miniature loaded sacks in the Meccano system, part No. 122. We advise you to purchase these for the purpose you mention. (*Reply to S. O. L. Andrew, Lees, Oldham*).

DETACHABLE THIRD RAIL.—It is doubtful whether there would be any great demand for a detachable third rail to convert ordinary track into electric track. We have had one or two suggestions of this nature, however, and we shall give the idea careful consideration. (*Reply to A. P. Goodricke, Branksome Park, Dorset, and E. W. Stevens, Birchington, Kent*).

SWISS TRAIN.—At present there is no likelihood of our introducing Swiss trains. We are concentrating upon improving our English trains. (*Reply to G. K. Sutcliffe, Leeds*).

LATTICE GIRDER BRIDGE.—Bridges of this and similar types may be made so easily from Meccano that there is no object in introducing them into the Hornby System. (*Reply to J. Peach, Belmont, Sutton, Surrey*).

SEPARATION OF COAL BUNKER FROM CAB.—You are quite right in stating that usually in actual railway practice the coal bunker of a tank engine is separated from the cab by means of a partition. Your suggestion therefore is a very practical one and we will give it full consideration. (*Reply to G. Spillman, Johannesburg, S.A.*).

ELECTRIC DOUBLE TRACK.—So far we have not considered the manufacture of double track with a centre rail insulated for electric trains. It is very possible however that such track will be developed later. (*Reply to S. Wentworth James, Langside, Glasgow, and D. H. Cooper, Crewe, and others*).

SMALLER FLANGES FOR TINPLATE WHEELS.—We are afraid there is no possibility at present of any alteration being made in the size of the flanges of our tinplate rails. If you require wheels with smaller flanges we suggest that you should use the Mansell wheels that were announced last month. (*Reply to D. H. Garratt, Workington*).

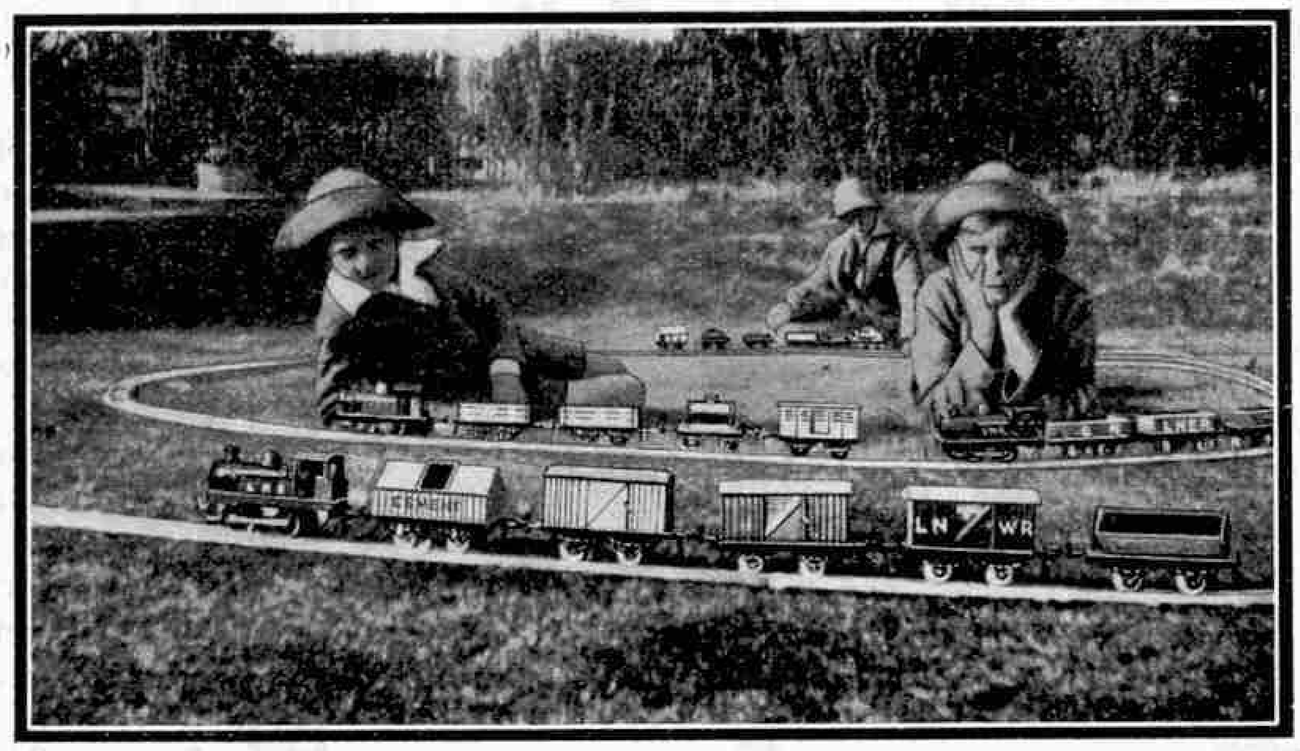
OIL LAMPS FOR STATIONS.—We do not consider that oil lamps for illuminating Hornby track and stations would be any improvement upon the present type of electric lamps; on the other hand we think they would be very inferior in many respects. (*Reply to M. Thorburn, Ashton-u-Lyne*).

COLOURED SMOKEBOXES.—Many boys still suggest we should colour the smokeboxes of Hornby locomotives black as in actual practice. We have already announced the fact that all the latest Hornby engines have their smokeboxes coloured black. (*Reply to H. G. Williams, York, L. Harris, Fife, and J. Webster, Gloucester*).

SERIAL NUMBERING.—We do not see that there would be any advantage to be gained by adopting your suggestion and putting serial numbers on our locomotives starting with No. 1 as in actual railway practice. Details of this kind would cause great increases in the cost of manufacture. (*Reply to G. Newton, Croydon, and B. Y. Crilley, Epsom, New Zealand*).

LIFE GUARDS FOR LOCOMOTIVES.—Life guards will be fitted to any new locomotives that we design if possible. (*Reply to J. Nicholls, Redhill*).

MODEL RAILWAY FUN IN THE GARDEN



Our photograph shows how three railway enthusiasts combined their engines, rails and rolling stock, and made themselves happy in the garden. We are often asked if there is any reason why a Hornby Railway should not be taken out of doors on hot days in summer. There is not the slightest objection to this provided that the ground is quite dry and that all material is brought indoors at night. If the layout is to be on a lawn it is, of course, necessary that the grass should be short.

RACK RAILWAY.—The introduction of a rack system for use on steep gradients is scarcely suitable for introduction to the Hornby System and we feel sure that it would meet with very little demand. (*Reply to M. Barry, Fleetwood*).

GAUGE 1 MODEL.—The popularity of Gauge 1 models is decreasing and we are quite sure that if we produced them they would meet with very little demand. (*Reply to J. Masters, Penarth*).

ACCUMULATORS IN TENDERS.—We are interested in your idea regarding the possibility of fitting accumulators in the tenders of our electrically-driven locomotives for the benefit of enthusiasts who only possess ordinary track and desire to run electric models. We are afraid that this idea is not suitable, however, as apart from the inconvenience of having to recharge the accumulator very often, the advantage of an electric locomotive is that it can be controlled from a fixed point at the side of the line, and this would not be possible if the source of power were in the tender. (*Reply to H. Young, Huddersfield*).

LOWER BUFFER BEAMS.—We thank you for your sketch and description of your proposed Hornby coach with a lower buffer beam. We agree that it looks very realistic and, as a matter of fact, you will be interested to learn that on all our new rolling stock the buffer beams will be lowered to the scale height. (*Reply to R. Gardener, London, N.*19).

COW CATCHERS FOR LOCOMOTIVES.—Your idea of fitting Hornby locomotives with cow catchers is interesting, though we are afraid quite unsuitable in the case of the Hornby System, as our locomotives are intended to represent English locomotives and these are not fitted with cow catchers in actual practice. (*Reply to J. Potter, Sheffield*).

MODEL RAILWAY PHOTOGRAPHIC COMPETITIONS.—We are proposing to hold a series of competitions of this kind and the first announcement will probably be made next month. (*Reply to H. Gilmour, Wavertree*).

TRACK BALLAST.—Your suggestion that we should supply small packets of material for ballasting the track is quite good but we do not feel sure that there would be any great demand for such material, Chicken grit or pebble dash can usually be obtained locally without any trouble. (*Reply to G. Wright, London, E.*6).

MINIATURE TARPAULINS.—These are now ready for sale and may be obtained for 6d. each or in envelopes, each containing half-a-dozen, for 3/-. (*Reply to G. Dobson, London, E.*6).

CHECK RAILS.—Although we agree that check rails would make the running of Hornby Trains over points a little more safe, we doubt whether it would be worth while introducing them. The prices of points fitted with check rails would be considerably in excess of those ruling at present, and the advantages to be gained would be comparatively small. (*Reply to Norman Fisher, Edinburgh*).

'SENTINEL' CAMMEL COACHES.—As soon as this type of coach becomes more universal we will consider introducing models of it. (*Reply to W. Mason, Newcastle-on-Tyne*).

DETACHABLE HEAD LAMPS.—We will manufacture detachable head lamps for our locomotives as soon as possible. (*Reply to I. A. Hayward, London, N.*3).

No. 2 MILK TRAFFIC VAN.—We think that the No. 2 Cattle Truck should satisfy your requirements in this direction. (*Reply to G. Jarrett, Clevedon, Som.*).

BOGIE CORRIDOR COACHES.—This suggestion is becoming increasingly popular. We will consider the introduction of coaches of this kind. (*Reply to G. Jarrett, Clevedon, Som., and D. Philips, Crawley*).

MODEL ENGINE DRIVER AND FIREMAN.—There is no doubt that miniature figures of this kind would add to the realistic appearance of a footplate and possibly we may adopt the suggestion later. (*Reply to G. Dobson, London, E.*6).

LARGER TURNTABLE.—A turntable sufficiently large to accommodate the No. 2 and No. 3 engines and tender would be far too clumsy to be of practical use and for the time being at any rate we do not propose to increase the size of our present turntable. The lack of a larger turntable does not prevent a railway from being run quite efficiently, however, as these locomotives are fitted with reversing mechanism. (*Reply to J. S. Gardner, Ilfracombe*).

WHISTLE ON GREAT WESTERN LOCOMOTIVES.—We agree with you that the No. 3 Great Western Locomotives look incorrect with a standard brass safety valve and an ordinary safety valve fitted to them. The new 'Caerphilly Castles' will be fitted with a whistle on the firebox in place of the old safety valve. (*Reply to M. Spencer, Manchester*).

STEAM DOMES.—The Hornby locomotives you mention fitted with brass domes must be rather old, as all our latest engines have coloured domes similar to their prototypes. (*Reply to G. Wilcox, Guildford*).

MILK CONTAINER WAGONS.—We propose to introduce wagons of this kind as soon as possible. (*Reply to D. Aston, Paisley*).

OVERHEAD WIRE FOR ELECTRIC TRAINS.—It would be a very costly matter to introduce an overhead wiring system for electric Hornby Trains. An apparatus of this kind would have to be very fragile to be realistic, and there are many other reasons for our not adopting the idea. (*Reply to G. Welford, Rossendale*).

3 ft. RADIUS RAILS.—We are unable to give this suggestion consideration, but you will be interested to know that the outer curves of the new Hornby double track are about 2 ft. 6 in. radius. This should enable you to test your Meccano model six-coupled locomotives. (*Reply to M. Neville, Windermere*).

MINIATURE FOG SIGNALS.—We cannot possibly consider introducing miniature fog signals at present. Details of this kind are not necessary on any model railway. (*Reply to H. I. Johnson, Newcastle, Staffs.*).

New Meccano Models

Alternating Swings—Goose—Jumping Horse—Tricyclist—Bucket Excavator

SINCE January of this year we have included under the heading "New Meccano Models" descriptions of more than fifty models, all of which have been designed on new and original lines and may be built by any Meccano boy. Those "*M.M.*" readers who set out to build every model shown in these articles as well as the special models described separately each month, have therefore been kept extremely busy! And now, lest they should find a few moments of their spare time unappropriated during the next few weeks, we are illustrating five more models for them to build.

Alternating Swings

The interesting model shown in Fig. 1 is driven from a Meccano Clockwork Motor and will run for several minutes from a single winding. The two swing boats work alternately in a most realistic manner.

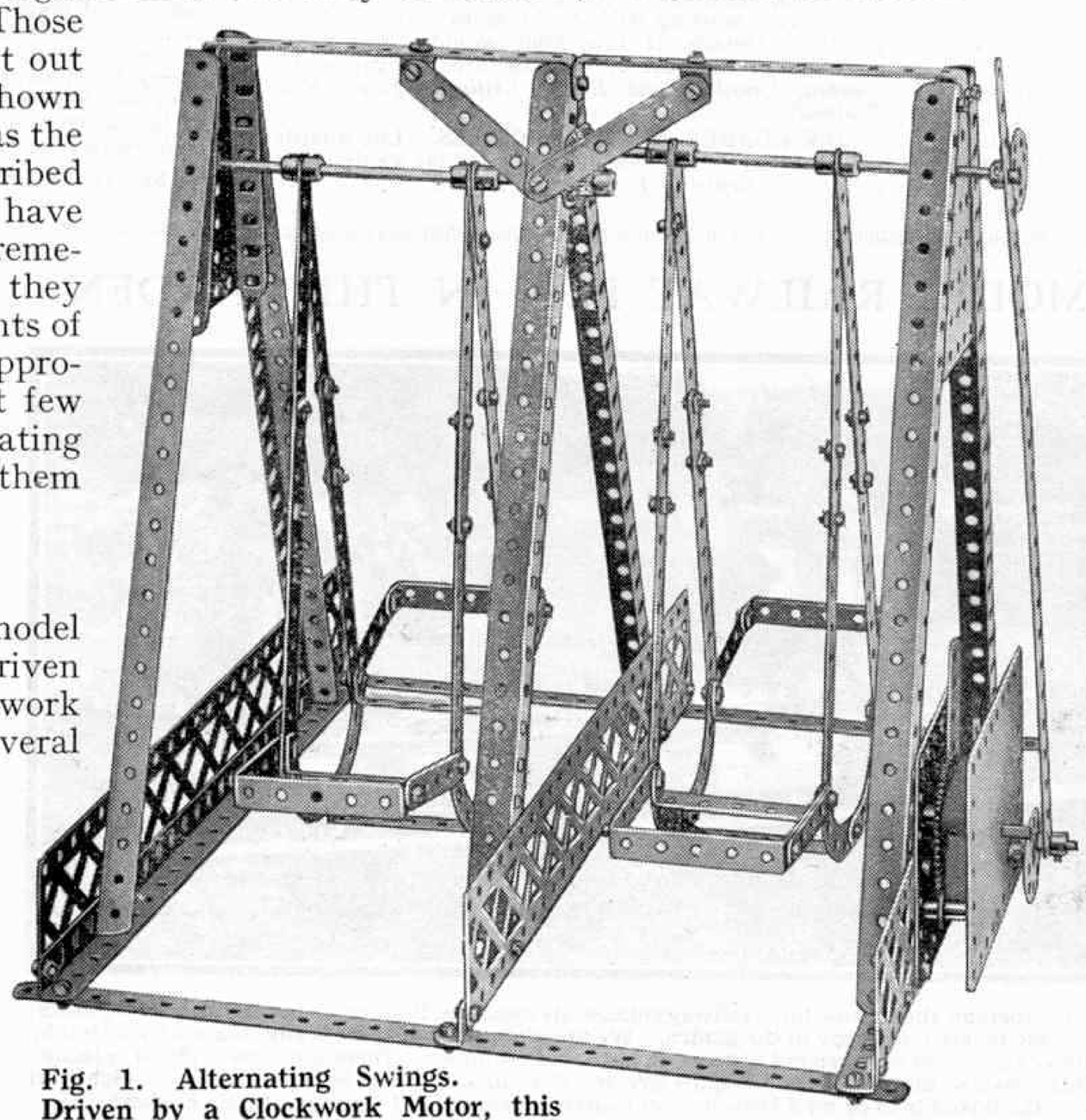


Fig. 1. Alternating Swings. Driven by a Clockwork Motor, this model works excellently

The boats are suspended by a series of $5\frac{1}{2}$" Strips, the upper ends of which are secured by Cranks and Collars to Axle Rods journalled near the top of the model. A $\frac{1}{2}$" Pinion on one of these Rods meshes with a similar Pinion on the other Rod; these Pinions cause the boats to swing in opposite directions.

A Bush Wheel is secured to the end of one of the Rods and a short Strip is bolted to it to form an extended crank. A similar Wheel is fastened to the driving shaft of the Clockwork Motor, and is coupled loosely to the end of the short Strip by means of a $12\frac{1}{2}$" Strip. Hence, when the Motor is set in operation, a rocking motion is imparted to the upper Bush Wheel, thus setting the swings in motion.

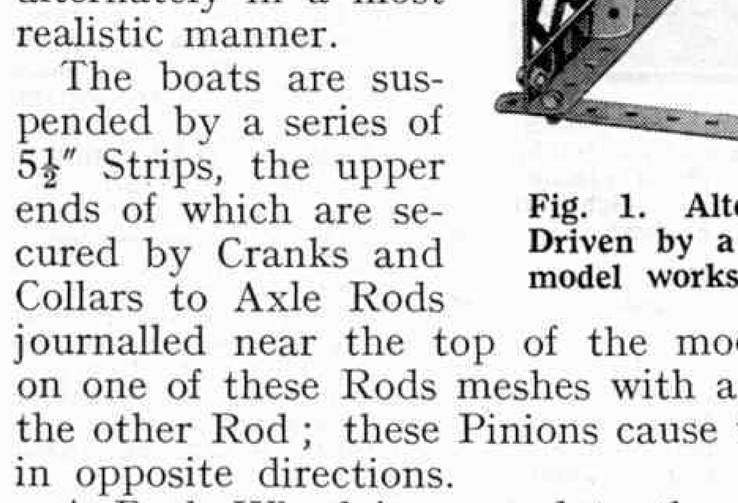


Fig. 2 The Meccano Goose demonstrating the "goose step"

The parts required to build this model are as follows:—3 of No. 1; 8 of No. 2; 2 of No. 4; 9 of No. 5; 2 of No. 6a; 8 of No. 8; 4 of No. 12; 2 of No. 14; 2 of No. 24; 2 of No. 26; 72 of No. 37; 3 of No. 37a; 10 of No. 48a; 2 of No. 48d; 2 of No. 54; 9 of No. 59; 2 of No. 62; 8 of No. 98; 3 of No. 99; 1 of No. 111c; 1 of No. 115; 1 Clockwork Motor.

The Meccano Goose

Here is a 00 Outfit model that will amuse one's younger brother or sister. A model farmyard could very easily be stocked with objects of this kind and doubtless some very amusing results could be so obtained.

The body of the "bird" consists of two Flat Trunnions, bolted together as shown, and a $2\frac{1}{2}$" small radius Curved Strip secured to each of the Trunnions. Two Flat Brackets and a $\frac{1}{2}$" loose Pulley represent the head, neck and beak. The legs and feet consists of Flat Brackets and Angle Brackets, one of the latter being secured to a $5\frac{1}{2}$" × $2\frac{1}{2}$" Flanged Plate. The model is completed by another $2\frac{1}{2}$" Curved Strip bolted at the rear of the Flat Trunnions, its protruding end serving as a tail.

The Goose comprises: 4 of No. 10; 2 of No. 12; 1 of No. 23; 8 of No. 37; 1 of No. 52; 2 of No. 90a; 1 of No. 111c; 2 of No. 126a.

Jumping Horse, with Jockey

This model should obtain a smile from even the most serious minded model-builder. From the illustration (Fig. 3) it will be seen that the designer's intention was to devise a model of a horse and rider in the act of clearing a fence and we think readers will agree that he has succeeded remarkably well.

The rider is composed of a Flat Trunnion with $2\frac{1}{2}$" Strips for his arms and $2\frac{1}{2}$" Curved Strips for his legs. A $\frac{1}{2}$" loose Pulley forming his head is secured to his body by means of a Flat Bracket. The horse is bolted to a $5\frac{1}{2}$" × $2\frac{1}{2}$" Flanged

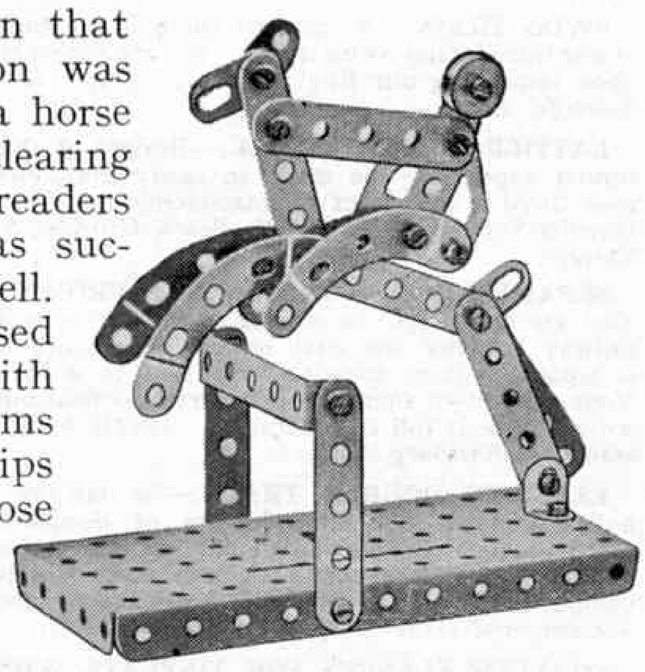


Fig. 3. "Over the Sticks"; an incident in the career of the Meccano horse and jockey

Plate by means of an Angle Bracket. The parts necessary to build the model are: 8 of No. 5; 4 of No. 10; 1 of No. 12; 1 of No. 23; 14 of No. 37; 1 of No. 48a; 1 of No. 52; 4 of No. 90a; 1 of No. 111c; 1 of No. 126a.

The Meccano Tricyclist

Keen Meccano boys will probably recognise in the Tricyclist illustrated in Fig. 4, a certain similarity to the "daring motor cyclist" described by Dick in his "Adventures in Meccanoland."

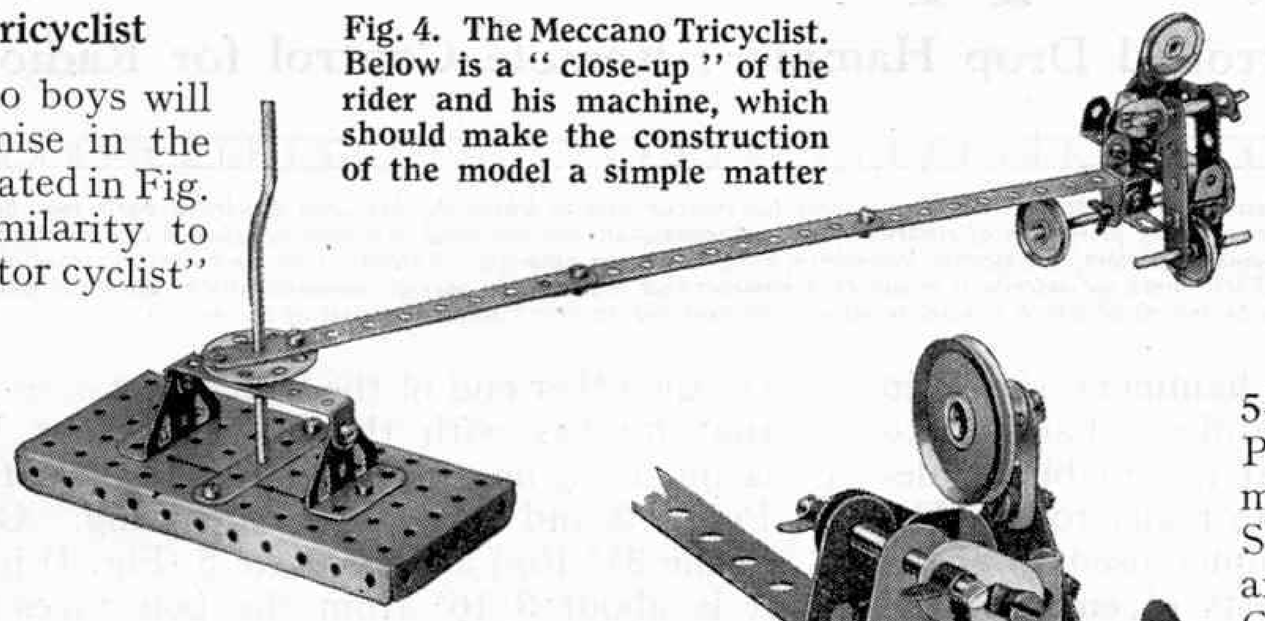


Fig. 4. The Meccano Tricyclist. Below is a "close-up" of the rider and his machine, which should make the construction of the model a simple matter

A $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip forming the saddle of the tricycle is bolted at one end to a Double Bracket and in the second hole from the other end to a Cranked Bent Strip. Two $2\frac{1}{2}''$ Strips are secured to the Double Bracket as shown, and a $1\frac{1}{2}''$ Axle Rod carrying a 1" fast Pulley is journalled in their lower ends while a $1\frac{1}{2}''$ Axle Rod forming the handle bars is secured in their upper ends by means of Spring Clips. The Flat Trunnion forming the body of the rider is bolted to the Double Angle Strip by means of an Angle Bracket.

Three $5\frac{1}{2}''$ Strips are bolted together to form an arm $14\frac{1}{2}''$ long, one end of which is secured to the Bush Wheel on the Crank Handle and the other end is bolted to the Tricycle. On turning the handle the Tricycle is caused to run round in a circle.

The model comprises the following parts: 3 of No. 2; 3 of No. 5; 3 of No. 10; 1 of No. 11; 5 of No. 12; 1 of No. 16; 2 of No. 17; 1 of No. 19s; 4 of No. 22; 1 of No. 24; 5 of No. 35; 25 of No. 37; 1 of No. 44; 2 of No. 48a; 1 of No. 52; 2 of No. 125; 2 of No. 126; 1 of No. 126a.

Steam Shovel, or Bucket Excavator

The model illustrated in Fig. 5 should find favour with most Meccano boys, principally for the reason that while forming an interesting model incorporating most of the movements of an actual steam shovel it does not use an excessive number of parts. Moreover, a model of this type will have a special appeal to those model-builders who possess a Hornby Railway System, for endless fun may be obtained in loading sand and gravel, etc., into the wagons by its aid.

The travelling base is built up as follows. Two $12\frac{1}{2}''$ Angle Girders are spaced apart by $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates as shown, and $2\frac{1}{2}''$ Curved Strips are bolted to them to form bearings for the Axle Rods carrying the travelling Flanged Wheels. A 3" Pulley is bolted to the centre of the base and a similar Pulley secured to the superstructure fits over it. A short Rod secured in one of the Pulleys is free to turn in the boss of the other, thus forming the central pivot. Those constructors who have a new Ball Bearing (part No. 168) in their possession should certainly make use of it in this model, for smoother working and greater realism will be obtained.

A $3\frac{1}{2}''$ Axle Rod supporting two $5\frac{1}{2}''$ Strips is journalled in two Sector Plates and held in position by means of 1" fast Pulleys. These Strips are lock-nutted to the bucket arm, which consists of $12\frac{1}{2}''$ Angle Girders spaced apart by Double Brackets and carries a Digger Bucket (part No. 169) at one end. The $5\frac{1}{2}''$ Strips also are connected pivotally to a lever fitted near the Boiler end of the Motor by means of a $9\frac{1}{2}''$ Strip. When the lever is pushed or pulled the effective length of the bucket arm is increased or decreased.

The Digger Bucket is opened by pulling a cord, which releases a catch that holds the bottom plate in position. The cord is led back to a position conveniently close to the lever that operates the bucket arm.

The 1" fast Pulley secured to the armature spindle of the Electric Motor drives the 3" Pulley shown, and a second 1" fast Pulley on the axle of the latter, is connected by another endless cord to a second 3" Pulley on the hoisting shaft. The cord winding on this shaft passes over the $\frac{1}{2}''$ loose Pulley at the end of the jib and is tied to the bucket arm. Hence operation of the Motor raises or lowers the bucket.

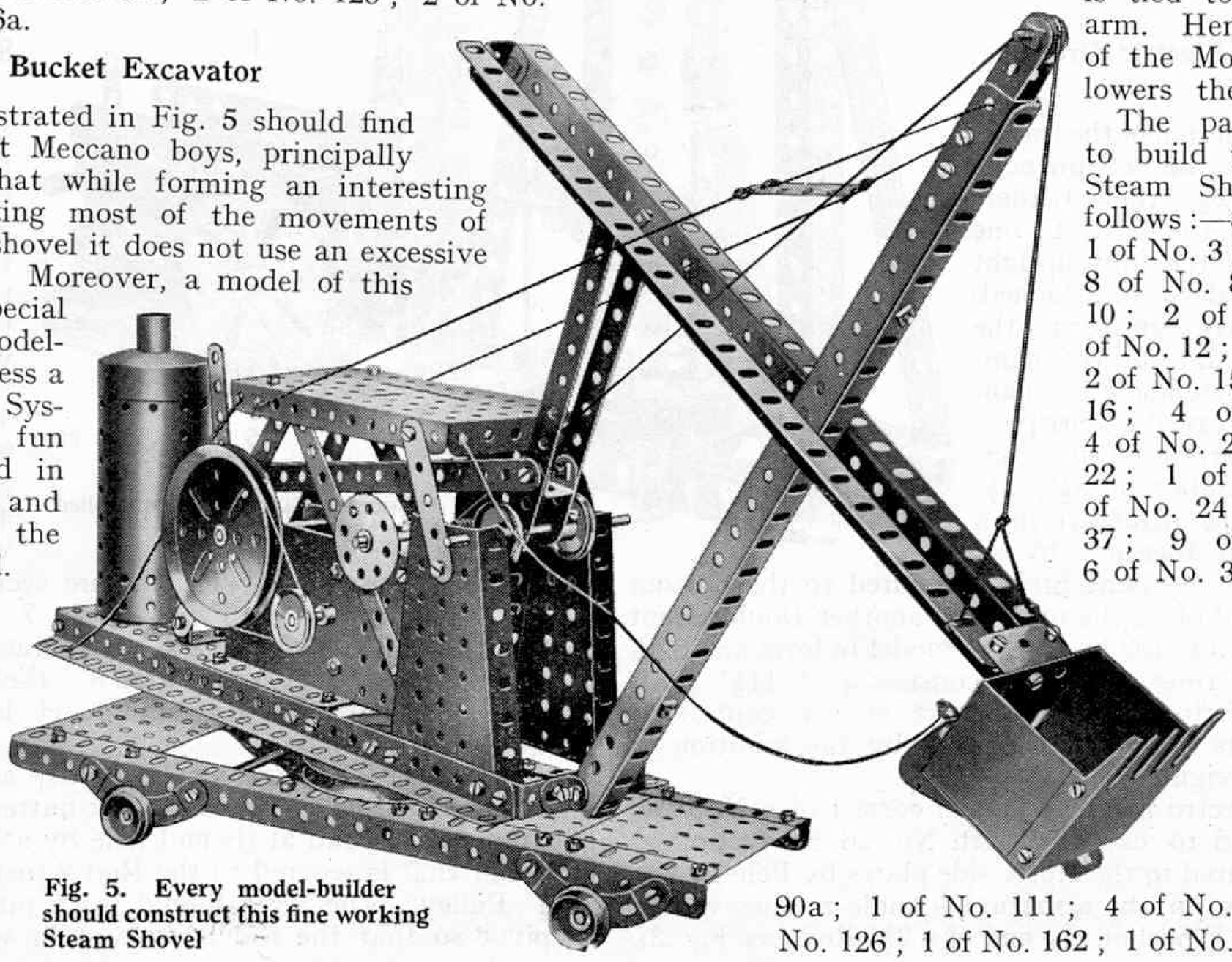


Fig. 5. Every model-builder should construct this fine working Steam Shovel

The parts required to build the Meccano Steam Shovel are as follows:—8 of No. 2; 1 of No. 3; 5 of No. 5; 8 of No. 8; 1 of No. 10; 2 of No. 11; 7 of No. 12; 1 of No. 15; 2 of No. 15a; 3 of No. 16; 4 of No. 19b; 4 of No. 20; 4 of No. 22; 1 of No. 23; 1 of No. 24; 88 of No. 37; 9 of No. 37a; 6 of No. 38; 1 of No. 46; 1 of No. 48; 3 of No. 48a; 2 of No. 48b; 2 of No. 52; 3 of No. 53; 2 of No. 54; 3 of No. 59; 4 of No. 90a; 1 of No. 111; 4 of No. 111c; 1 of No. 126; 1 of No. 162; 1 of No. 169.

Electricity Applied to Meccano

XII—Electrically-controlled Drop Hammer; Remote Control for Radio Set

These articles are intended to draw every Meccano boy's attention to the numerous fascinating uses to which the Meccano Electrical parts may be put. The first two articles of the series dealt with the elementary principles of electricity, and subsequent articles described Meccano switches, a coil winding machine, a telegraph system, electro magnets, a galvanometer, motors, an electric locomotive, bells, lamps, an ammeter, an electric sign, an electrically-controlled railway, and electric beam and horizontal engines. This month we describe a model drop hammer that is caused to operate automatically by electrical means, and an extremely simple device by means of which a wireless set may be switched on or off from any part of the house.

AS every Meccano boy knows, hammers range in size from the "tack" or "toffee" hammer to the great steam hammer that is capable of delivering blows of a force equivalent to many tons. The latter is, of course, the type of hammer used to shape masses of white hot metal into parts of engines, etc. Another extensively used type is the "drop" hammer, and it is to this class of hammer that the model illustrated on this page belongs.

The most interesting feature of the model is the method by which the hammer is dropped automatically by electrical means. Once in motion the model may be allowed to go on working independently, the hammer falling at regular intervals from a maximum height, or by moving a lever the stroke of the hammer—and therefore the power of the blow—may be increased or decreased as desired. Hence the model is an excellent one for demonstration purposes. As illustrated on these pages, it may be made with comparatively few parts, but if desired it may of course be elaborated considerably.

Building the Electric Drop Hammer

The construction of the framework should be commenced first. Two 12½" Angle Girders (Fig. 1) form the base, to one end of which the four upright 9½" Angle Girders are attached. These last Girders form the supporting frame for the hammer and its attendant mechanism, and are stayed by Strips.

The hammer, or "tup," consists of a number of 3½", 2½" and 1½" Strips arranged in a pile and held together by ¾" Bolts. A Double Bent Strip is secured to the bottom or striking end of the hammer and another Double Bent Strip is secured to the base of the model to form an anvil. The hammer runs on guides consisting of 11½" Rods carried by Strips that form part of the containing frame, and its weight is increased by the addition of 25-gramme weights.

The two electro magnets 1 each consist of a Meccano Bobbin wound to capacity with No. 26 S.C.C. Copper Wire and secured to the Motor side plates by Pole Pieces.

A ¾" Pinion on the armature spindle meshes with a 50-teeth Gear Wheel on the end of a 2½" Rod (see Fig. 3). On the other end of the latter Rod is secured a ½" Pinion that meshes with the 57-teeth Gear Wheel 4, which is mounted on the end of a 3½" Rod that carries a ¾" Pinion 2 and a Compression Spring. On the other end of the 3½" Rod a Face Plate 5 (Fig. 1) is secured so that it is about 3/16" from the pole faces of the magnets when the boss of the Gear 4 is pressed against the Motor side plate. (The Face Plate is not shown in Fig. 3). In this position of the Rod the ¾" Pinion 2 should be just in mesh with a 50-teeth Gear 3 secured to the winding shaft.

The Compression Spring on the shaft of the Gear 4 normally holds the Pinion 2 in engagement with the Gear 3, the shaft of which winds up the length of cord that is attached to the hammer. At a given moment the electro magnets 1 are energised, with the result that they attract toward the pole faces the Face Plate 5. The movement of the latter compresses the Spring and throws the Pinion 2 out of engagement with the Gear Wheel 3. The Rod of the latter Wheel is then free to rotate and the hammer falls by its own weight.

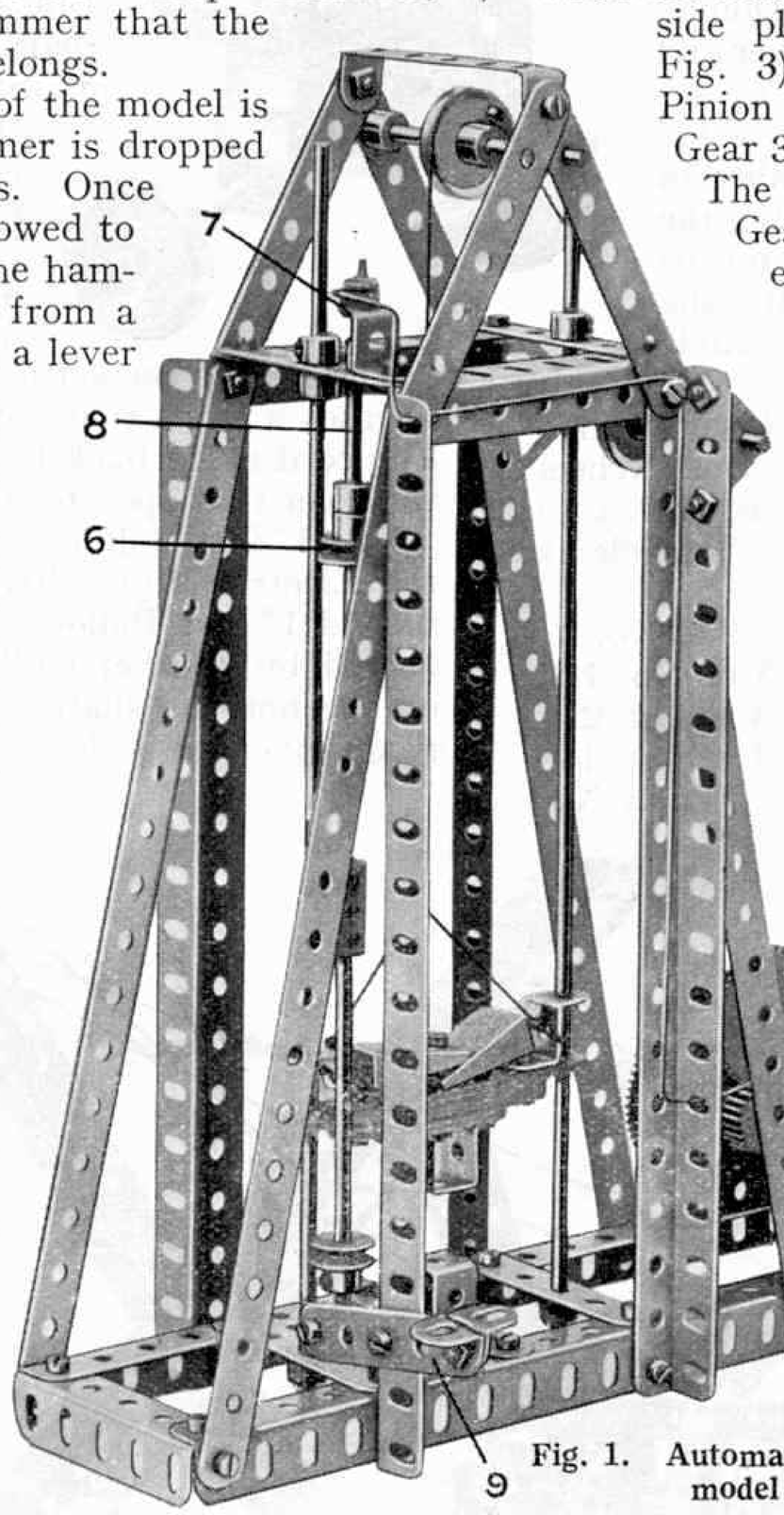


Fig. 1. Automatic Electrically-controlled model Drop Hammer

Arrangement of the Automatic Switch

The automatic switch controlling the magnets 1 consists essentially of a Rod 8 (Fig. 1) that is slidable in the Strips carrying the 11½" Rods which form the hammer guides. The Rod 8 is made 9½" in length by connecting 5" and 4½" Rods together with the aid of a Coupling, and two ½" Pulleys are secured to it in the positions shown. A 6 B.A. Bolt 7 is fastened head downward to a ½" Reversed Angle Bracket that is bolted to the Strip carrying the Rod 8; the bolt is insulated from the Reversed Angle Bracket by an Insulating Bush and Washer.

The lever 9 consists of a 2½" Strip attached pivotally at its centre by means of a lock-nutted bolt to the 9½" Angle Girder and at its end hole by a bolt inserted in a Collar that is secured to the Rod 8 just below the lower ½" Pulley. The lever should work rather stiffly on its pivot so that the rod 8 remains in whatever position

it may be struck by the hammer.

The Electrical Connections

The wiring diagram (Fig. 2) gives a clear idea of the various connections. One of the wires from each of the magnets 1 are connected together, the remaining wire of one magnet being taken to one of the Motor terminals whilst that of the other magnet is connected to the insulated bolt 7. The second terminal of the Motor is earthed by connecting it to a part of the frame of the model. The wires to the Accumulator are joined to the Motor terminals.

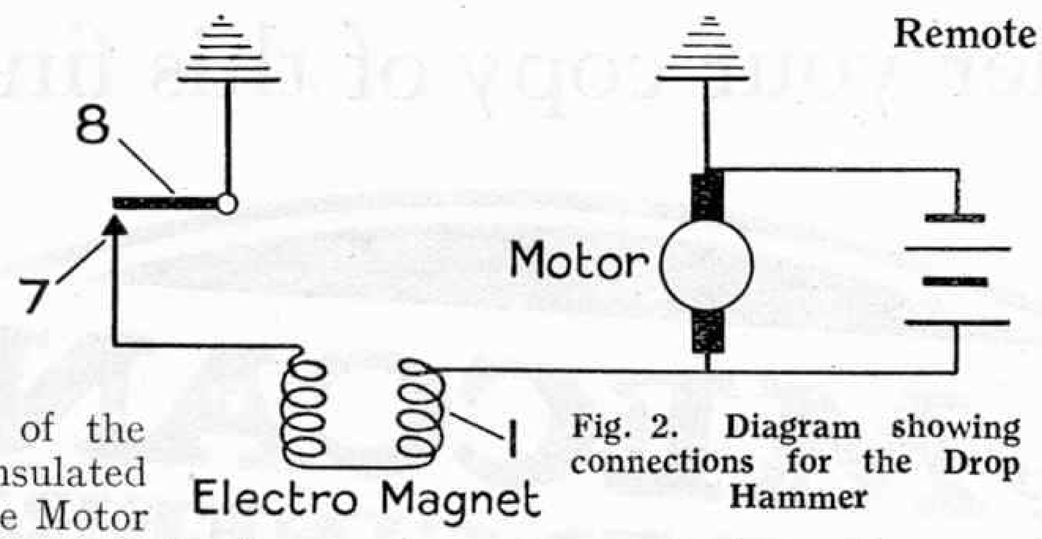


Fig. 2. Diagram showing connections for the Drop Hammer

When the Motor is started, the winding shaft on which the Gear 3 is secured rotates and hoists the hammer. As the hammer nears the top it hits the ½" Pulley 6, thereby striking the Rod 8 upward into contact with the 6 B.A. Bolt 7. This completes the circuit of the magnets, energising them and causing the Face Plate 5 to be drawn to them, a movement which, as already explained, causes the disengagement of the Pinion 2 with the Gear 3. The hammer then falls and strikes the lower ½" Pulley on the Rod 8 thereby returning the latter to its original position. The magnet circuit is now broken and the Gear and Pinion come into mesh once more, owing to the action of the Compression Spring. This cycle of operations is repeated for as long as the current is running.

By moving the Strip 9 the circuit of the magnet may be completed before the hammer reaches the top of its stroke. Thus the force of the blow may be regulated to a nicety by causing the hammer to fall through a shorter distance.

The 11½" Rods on which the hammer slides and the various gears, etc., must be kept well oiled to ensure the correct working of the model. The Rod 8, however, should not be oiled.

The parts required to build the complete model drop hammer are as follows :—

4	of No.	1A	3	of No.	16B	2	of No.	111C
7	„ „	3	2	„ „	22	1	„ „	120B
12	„ „	5	2	„ „	23A	3	„ „	125
4	„ „	6A	2	„ „	25	2	„ „	126
2	„ „	8	1	„ „	26	2	„ „	301
4	„ „	8A	2	„ „	27	1	„ „	302
2	„ „	9B	1	„ „	27A	1	„ „	303
2	„ „	9D	39	„ „	37	1	„ „	304
2	„ „	12	2	„ „	45	1	„ „	305
2	„ „	13	1	„ „	48A	2	„ „	308
1	„ „	15	12	„ „	59	1	„ „	314
1	„ „	15A	1	„ „	63	1	Electric Motor, 4 volt.	
1	„ „	16	1	„ „	109			
2	„ „	16A	2	„ „	111A			

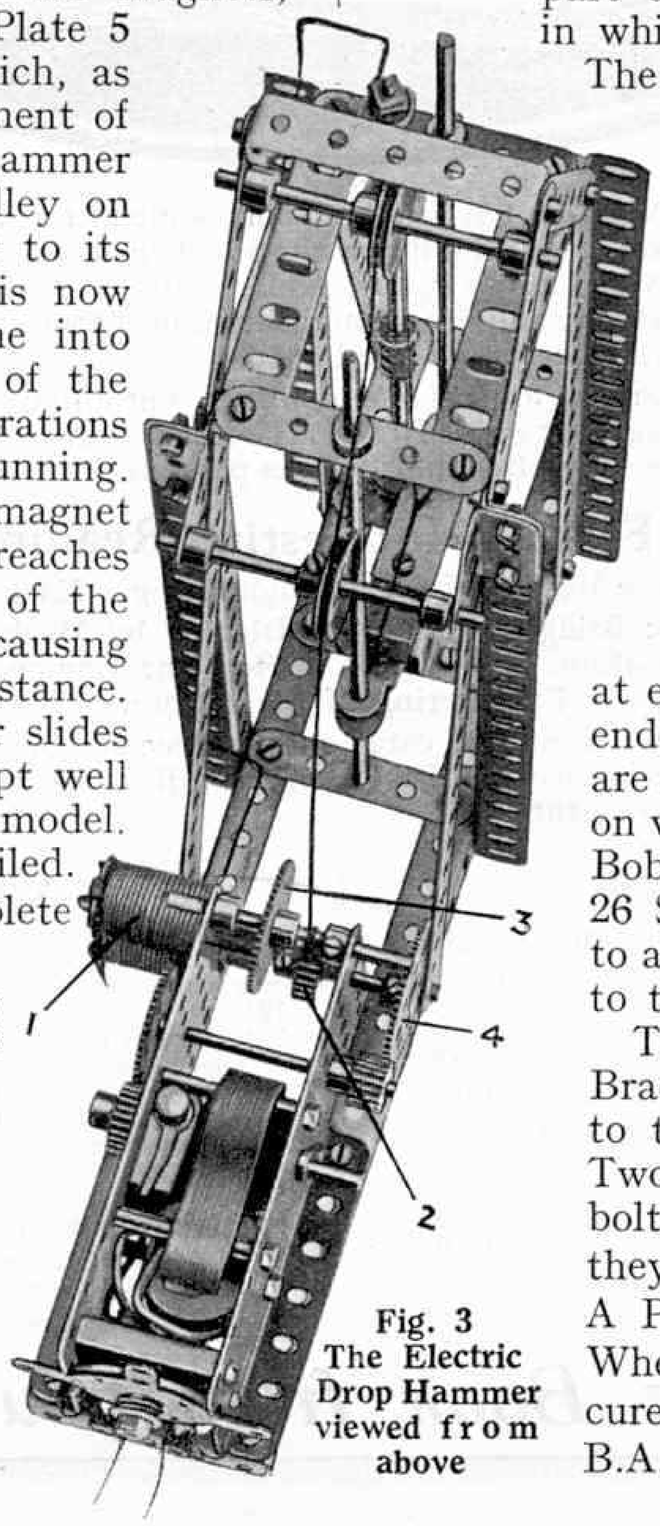


Fig. 3 The Electric Drop Hammer viewed from above

MECCANO ELECTRICAL PARTS

The following is a complete price list of the Meccano Electrical Accessory Parts. These parts are standardised with the rest of the Meccano system. They can be adapted with advantage to innumerable existing models, and they make possible many entirely new ones. They may be obtained through any Meccano dealer.

Part No.			s.	d.
301.	Bobbin	each	0	4
302.	Insulating Bush	doz.	0	6
303.	Insulating Washer	„	0	3
304.	6 B.A. Screws	„	0	6
305.	6 B.A. Nuts	„	0	3
306.	Terminal	each	0	1
307.	Silver-tipped Contact Screw	„	0	5
308.	Core or Pole Piece	„	0	3
309.	Coil Cheek	„	0	3
310.	Lamp Holder	„	0	3
311.	Best Metal Filament Lamp ...	each	0	6
312.	27 Gauge Bare Iron Wire, per length of 30"		0	1
313.	26 Gauge SCC Copper Wire, Reels of 50 yds.	each	2	3
314.	23 Gauge SCC Copper Wire, Reels of 25 yds.	„	2	0
315.	22 Gauge Bare Copper Wire, Reels of 4 yds. ...	„	0	3

Remote Control for Radio Sets

Nearly everyone nowadays is the happy possessor of a wireless set, and any innovation tending to increase the interest or enjoyment that may be obtained from it is always very welcome. The Remote Control device described below is a particularly useful accessory that any Meccano boy may construct for use in connection with any type of wireless set. It makes possible the switching on and off of the set from a distance, merely by pressing a small push button switch.

For example, the set might be in one room and one or more control switches placed in convenient positions in the other rooms so that the set could be switched off or on from any part of the house, without entering the room in which the set is situated.

The leads between the set and the remote control must be as short as possible in order that minimum resistance is inserted in the L.T. circuit. This is specially important with a multi-valve set which may consume a large amount of L.T. current. On the other hand the wires from the remote control device to the push button switch or switches may be of practically any length, since the current required to operate the magnet is quite small, of course.

The base of the instrument consists of two 5½" Angle Girders connected together at each end by 2½" Angle Girders. Near one end of the base so formed, two vertical Strips are secured to form the bearings for the Rod on which the Gear Wheel 9 is mounted. Two Bobbins next are wound to capacity with No. 26 S.C.C. Wire and attached by Pole Pieces to a 2½" × ½" Double Angle Strip that is bolted to the two upright Strips.

The end of a Strip 8 is bolted to a Double Bracket that is journalled on a Rod attached to the base by two ½" × ½" Angle Brackets. Two 1½" Strips, laid one upon the other, are bolted to the Strip 8 in such a position that they are opposite the pole faces of the magnets. A Pawl engages with the teeth of the Gear Wheel 9 and is mounted on a Pivot Bolt secured at the top end of the Strip 8. Four 6 B.A. Bolts are secured

(*Continued on page* 839)

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44 Pages

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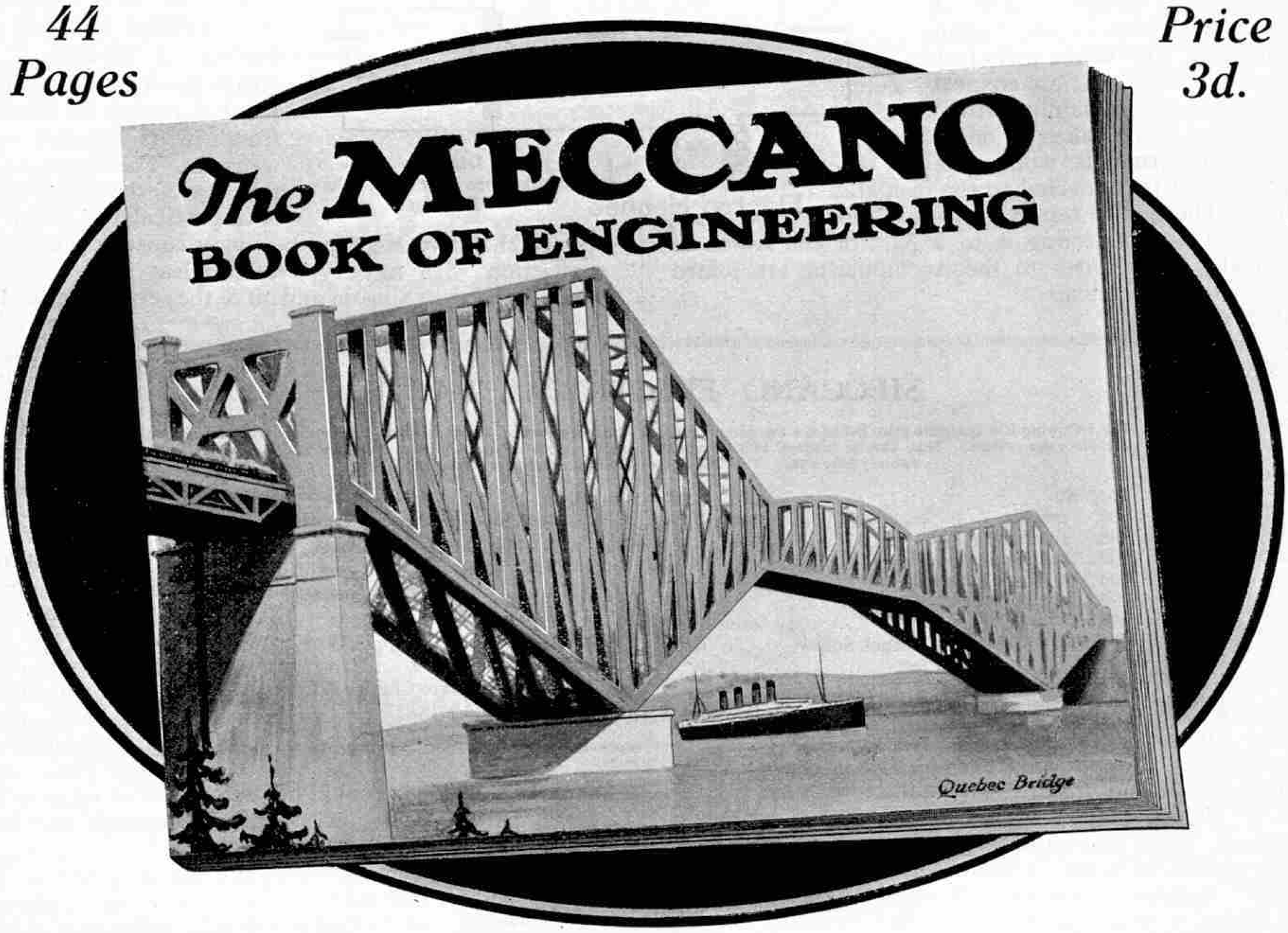

Here is a splendid new book that every Meccano boy will naturally want to read. It will be packed with interesting matter describing the world's greatest engineering feats. It will tell how the advance of civilisation has depended mainly on the engineer, who has built bridges, constructed harbours and breakwaters, and reclaimed deserts in the face of overwhelming odds. It will also tell the story of the famous Quebec Bridge and other engineering masterpieces, and it will include an interesting forecast dealing with that most fascinating subject, Engineering of the Future.

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There is a special edition of the Meccano Book of Engineering for Overseas, and copies will shortly be despatched to our agents to fill orders received. The price Overseas is 6d. post free (Canada 10 cents or 12 cents post free). Readers in Australia, New Zealand, South Africa or Canada who require copies should address their orders to our agencies as detailed below. All orders will be dealt with in strict rotation.

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AUSTRALIA.—E. G. Page & Co., 52, Clarence Street, Sydney. (P.O. Box 1832 K).
NEW ZEALAND.—Models Ltd., Kingston Street, Auckland. (P.O. Box 129).
SOUTH AFRICA.—Arthur E. Harris, 142, Market Street, Johannesburg. (P.O. Box 1199).
CANADA.—Meccano Ltd., 45, Colborne Street, Toronto.

You can order the Book from your Meccano Dealer

Electricity Applied to Meccano—(*continued from page* 837)

to the Gear 9 and insulated by Insulating Bushes.

The vertical $4\frac{1}{2}$" Double Angle Strip to which the wire 10 is attached, is secured to and insulated from the $2\frac{1}{2}$" Angle Girder on which it is mounted by a 6 B.A. Bolt and an Insulating Bush and Washer on the shank of the bolt. The wire 10 consists of a length of No. 22 Bare Copper Wire, bent as shown in the illustration in order that its end may dip into the centre hole of the Threaded Boss 1.

The bottom of the hole of the Threaded Boss should be plugged by a bolt and a drop of mercury placed in the hole. The tip of the wire 10 is submerged in the mercury to complete the L.T. circuit.

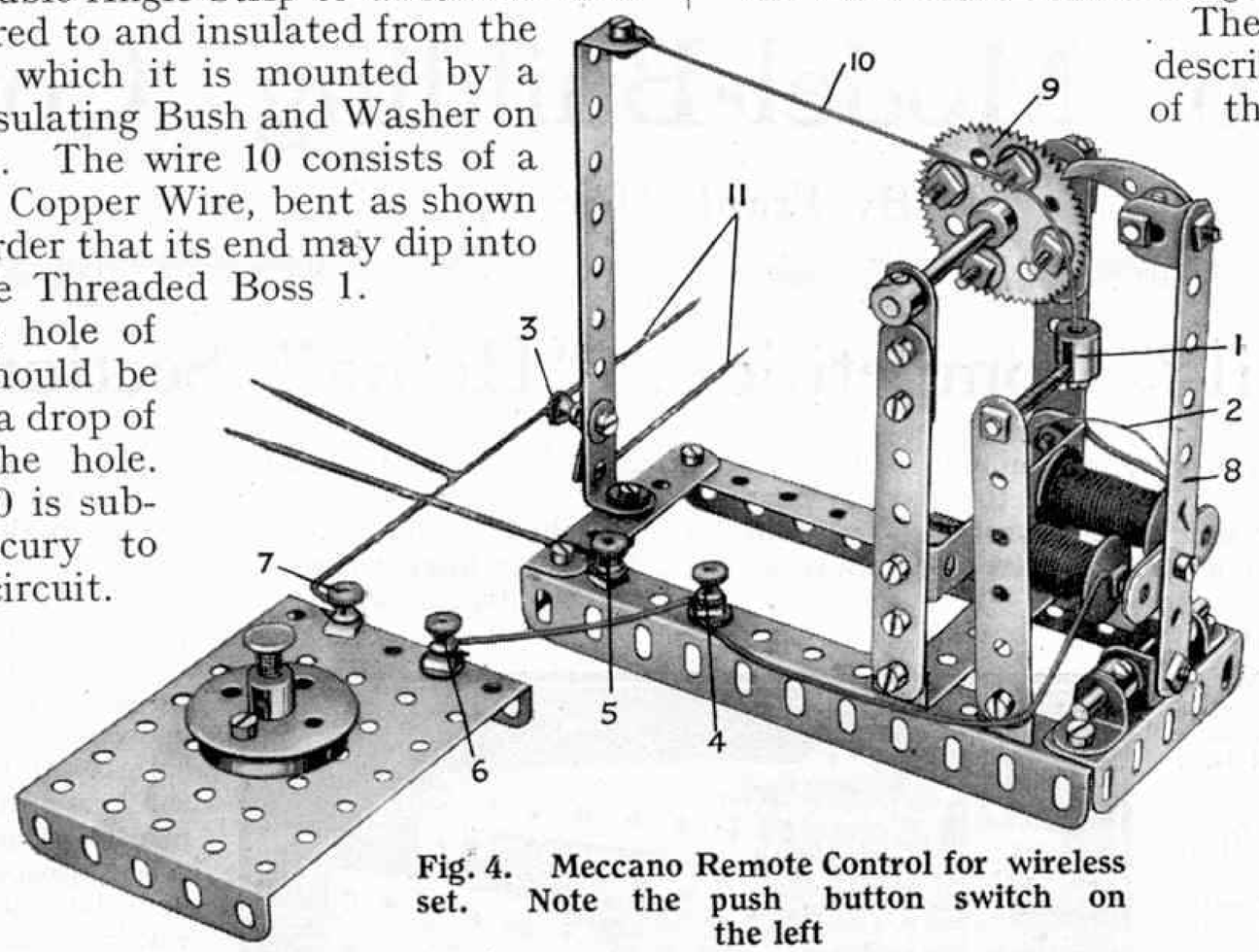


Fig. 4. Meccano Remote Control for wireless set. Note the push button switch on the left

Wiring the Apparatus

The wiring diagram (Fig. 5) should be consulted when making the connections. One end of the winding of one magnet is connected to one end of the other magnet winding. The remaining end of one magnet is earthed (by attaching it to the frame of the model) whilst the other magnet end is taken to the terminal 4. The latter is insulated from the Angle Girder by means of an Insulating Bush and Washer, but the terminal 5 is in direct metallic contact with the Girder, as also is the terminal 3 attached to the vertical $4\frac{1}{2}$" Double Angle Strip.

One of the wires 11 is held by the terminal 3 and taken to an L.T. terminal of the set, the other L.T. terminal being connected to the Accumulator. A continuation of the latter wire is led to the terminal 7 on the push switch. The other terminal of the Accumulator is connected to the terminal 5 of the remote control.

As already stated, the wires connecting the push switch to the remote control and the Accumulator may be of any convenient length, of course, as is indicated by the break in these wires shown in Fig. 5. The remote control and the wireless set should be arranged close together, however.

Normally the wire 10 rests on one of the insulated 6 B.A. Bolts projecting from the face of the 57-teeth Gear Wheel 9, but when the push of the switch is pressed down, the magnet circuit is closed and the Strip 8 drawn toward the pole faces of the magnets. This motion of the Strip 8 rotates the Gear 9 partially—through the action of the Pawl—and lowers the tip of the wire 10 into the mercury contained in the Threaded Boss 1. The L.T. circuit of the set is now complete. A single push of the button is all that is required to actuate the switch as the instrument functions practically instantaneously.

The Strip 8 is returned to normal by a short length of B.I. Wire 2, which acts as a spring. One end of this wire is attached to the Double Angle Strip carrying the magnets whilst the other end presses against the Strip 8.

When it is desired to discontinue using the set, the push is pressed once more. This rotates the Gear Wheel and lifting the wire 10, breaks the L.T. circuit and extinguishes the valves.

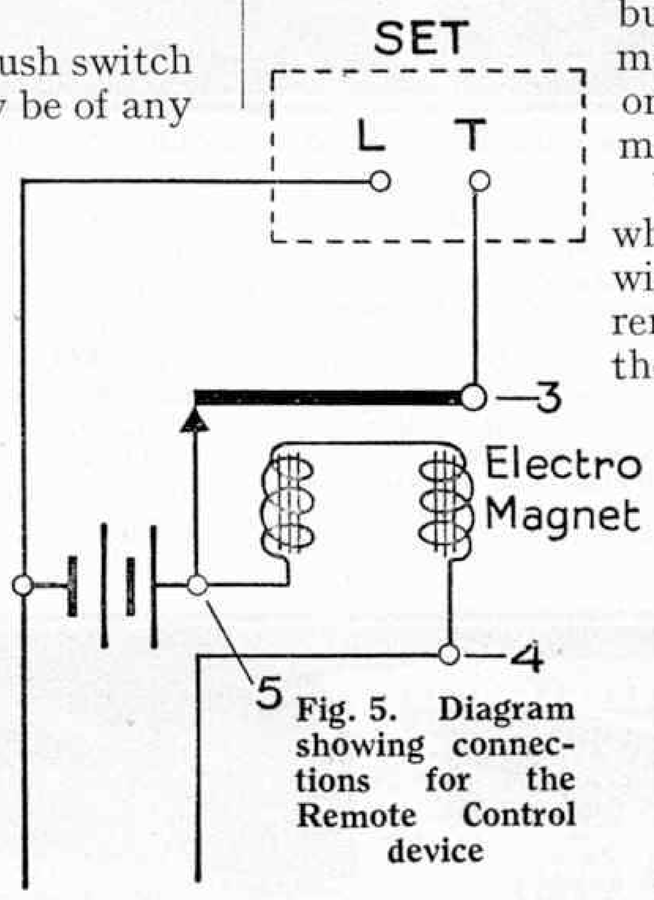


Fig. 5. Diagram showing connections for the Remote Control device

The push button switch was described fully in the third article of this series, which appeared in the "*M.M.*" for January, 1928, but for those of our readers who are unable to turn to a copy of this number of the "*M.M.*" we append a short description of the construction of the switch.

It consists essentially of a Flanged Wheel and Pivot Bolt. A small compression spring, obtained by cutting two or three turns off part No. 120b, is placed between the head of the bolt and the boss of the wheel. The contact piece consists of a 6 B.A. Bolt secured with its head immediately beneath the shank of the Pivot Bolt. If the switch is mounted on a metal base as in the illustration the contact bolt must be insulated, of course, by means of Insulating Bushes and Washers.

In making the connections, one wire should be secured to the $\frac{1}{2}$" Bolt holding the Flanged Wheel in place and another to the insulated contact bolt. The circuit is completed by pressing down the Pivot Bolt, which is prevented from falling out of position by a nut placed on its extreme inner end.

Of course, any other type of switch may be used, such as the Meccano single way switch that also was described in the January article, but the push button switch is the most suitable, since it is necessary only to energise the electro-magnets momentarily.

We would refer those of our readers who are not clear as to the method of wiring the switches to operate the remote control from several rooms to the diagram on page 516 of the June "*M.M.*" This diagram shows four switches controlling a single bell —the bell being substituted by the remote control in this case of course. By careful perusal of this diagram matters should be made quite clear with regard to the wiring of the switches.

Parts Required

For the construction of the remote control apparatus, with push button switch, the following parts are necessary:—

1 of No. 2A	1 of No. 17	1 of No. 64	10 of No. 305
2 „ „ 3	1 „ „ 20	1 „ „ 81	5 „ „ 306
1 „ „ 4	1 „ „ 27A	1 „ „ 111C	2 „ „ 308
4 „ „ 6A	21 „ „ 37	1 „ „ 120A	2″ „ „ 312
2 „ „ 9	5 „ „ 37A	1 „ „ 147	1 „ „ 314
2 „ „ 9D	2 „ „ 48A	2 „ „ 301	6″ „ „ 315
1 „ „ 11	1 „ „ 48C	8 „ „ 302	
4 „ „ 12	1 „ „ 53	8 „ „ 303	
1 „ „ 16B	4 „ „ 59	10 „ „ 304	

Results of Meccano Model-Building Contests

By Frank Hornby

"April" Competition, "Home" Sections

ORIGINALITY of design was a very prominent feature of the entries in this contest, and many of the models bear witness to considerable ingenuity and constructional skill on the part of their builders. The prizes have been awarded as follows:—

Section A (competitors over 14 years of age):

FIRST PRIZE (Cheque to value £3-3s.): W. P. Cole, Felbridge, Sussex. SECOND PRIZE (cheque to value £2-2s.): L. Lacey, St. Leonards-on-Sea. THIRD PRIZE (cheque to value £1-1s.): R. Mason, Leeds.

SIX PRIZES, each consisting of Meccano Radio Crystal Receiving Sets: J. C. Adams, West Hallam, near Derby; Dennis Toms, West Bridgford, Nottingham; W. R. Marsh, Bath, Somerset; R. C. Ashton, Devonport, Plymouth; H. Sarfas, Ilford; Thomas W. Baker, Taunton.

TWELVE PRIZES, each consisting of Meccano Single Telephone Receivers: E. Whatley, New Moston; T. Abbot, London, S.W.2; C. E. Wrayford, Teigngrace, near Newton Abbot; M. F. Couchman, Bognor; S. Gross, Colne; H. A. Davies, Gwytherin, Abergele; B. F. and G. A. Buckley, Wolverley; M. V. Jackson, Berkhamstead; G. E. Abecassis, Clifton, Bristol; F. Kennedy Oxten, Enfield; Herbert Clegg, Bradford; F. T. Dyer, Felsted.

SPECIAL COMMENDATION (Certificate of Merit and Standard Mechanisms Manual): Rodney S. Weaver, Prestwich, Manchester; H. Rutter, Consett, Co. Durham; John W. Rid, Birkenhead; A. P. Pallant, Wherstead, near Ipswich; E. C. Reeder, Mawgan-in-Meneage, Cornwall; Fred Bearne, Grantham; N. Downey, Sutton, Surrey.

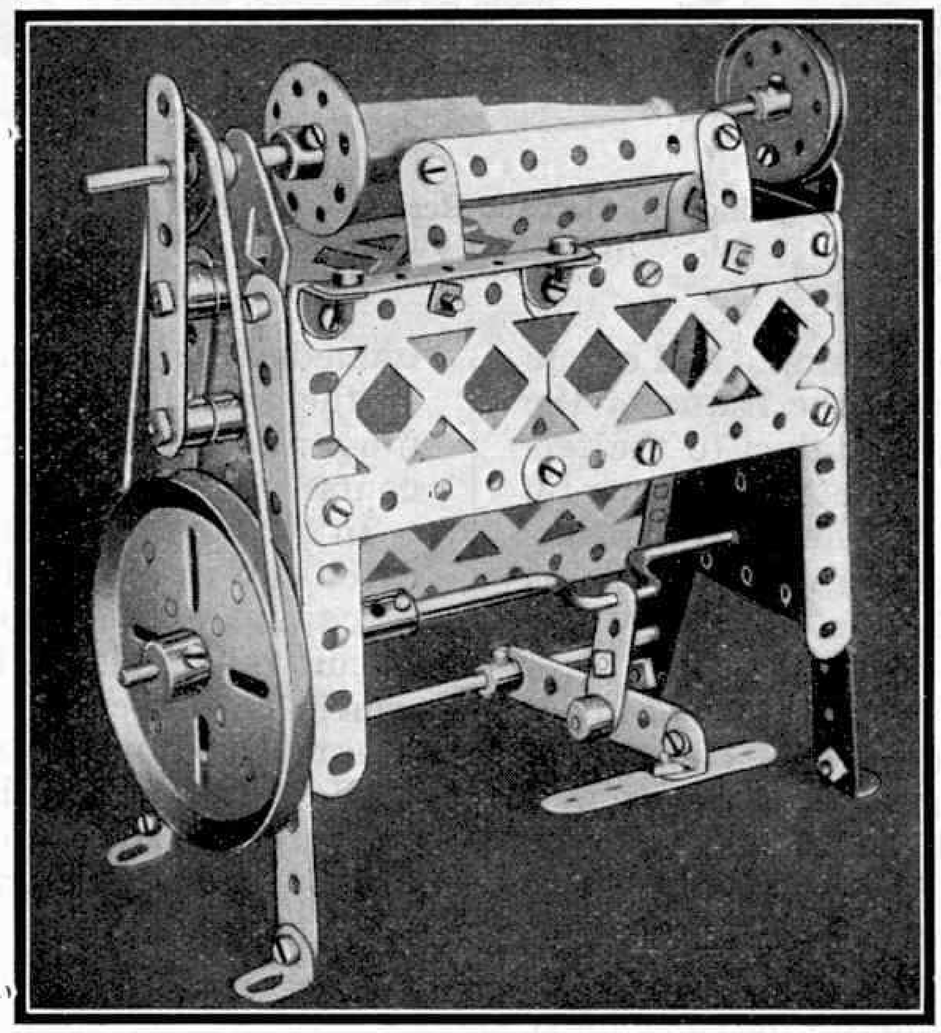
Section B (for competitors under 14 years of age):

FIRST PRIZE (Meccano products to value £2-2s.): M. H. Maufe, Ilkley. SECOND PRIZE (Meccano products to value £1-1s.): L. D. Smart, Kingston-on-Thames. THIRD PRIZE (Meccano Radio Crystal Receiving Set): P. Peacock, West Byfleet.

SIX PRIZES, each consisting of Meccano Single Telephone Receivers: R. H. Pike, London, W.1; L. A. Frayn, Plymouth; A. Diwell, Hastings; F. Hayes, Porthcawl; T. G. Pickavance, St. Helens; T. Sheppard, Wellingborough.

TWELVE PRIZES, each consisting of Complete Instruction Manuals: W. Raybould, Walsall; G. W. Garton, Leicester; A. E. T. Huggins, Gloucester; R. Dwight, Chesham; David Fevez, Addlestone; D. McLean, Manchester; N. R. Reid, London, S.E.2; R. H. Thomas, Coventry; T. B. Paisley, Brechin, Forfarshire; R. P. Atkins, London, W.C.1; N. Slater, Bournemouth; L. Randles, Wrexham.

SPECIAL COMMENDATION (Certificate of Merit and Standard Mechanisms Manual): H. Fazakerley, Heapey, near Chorley; R. Bush, Bromley; N. L. Mills, London, S.W.2; D. B. Kimber, Bedford; W. E. Blundell, London, E.3; G. Atherton, Littleborough, near Manchester; M. Mackirdy, Malmesbury; K. Black, London, N.21; B. K. Merson, Rotherham; O. S. Johnston, Stoke-on-Trent.



A practical model of a Wood-turning Lathe, built by T. Sheppard

Everyone knows how the screw has been used to propel ships through the sea or aeroplanes through the air, but it is not generally known that the principle can be used to drive a machine over the land. In the *"M.M."* for December, 1927, we described a "snow motor," and it is on this machine that W. P. Cole (First Prize-winner, Section A) based the interesting model shown at the foot of the opposite page. It may be recalled that the novel method of propulsion of the snow motor consists of two large drums placed on either side of the power unit. To the surface of these drums a narrow strip of metal is attached in the form of a spiral, so that the finished drums are in reality huge screws.

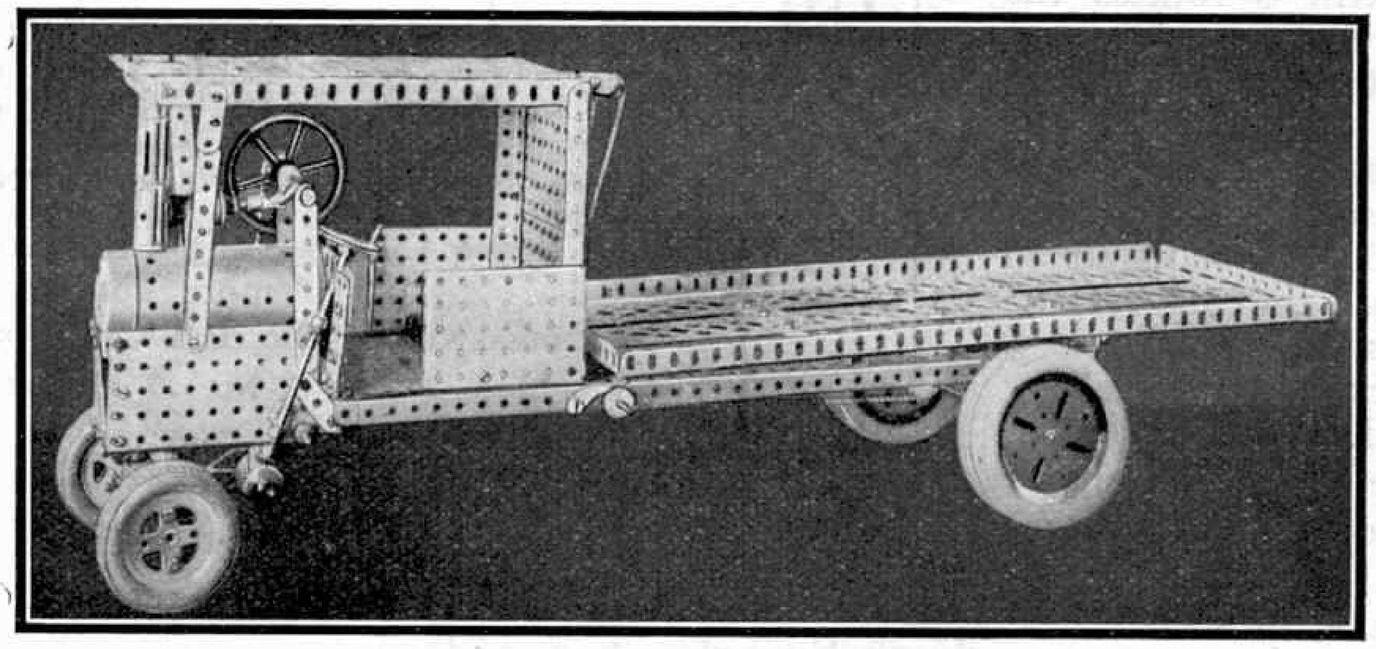
The drums are coupled by means of Sprocket Drive to the propeller shaft of the motor, and on starting up the latter the drums are caused to rotate. When placed on snow or sand, or even soft earth, the spirals on the drums force or worm the machine forward in a manner somewhat similar to that in which the screw propeller fitted to a ship or aeroplane forces its way through the water or air.

The drums have been represented in the model by means of a number of Strips and two Face Plates and a series of 2½" Curved Strips constituting the spirals. Each drum is rotated by means of the Electric Motor, the drive being transmitted to the Sprocket Wheels seen at the rear through a clutch and a two-speed and reverse gear box. The method of taking the drive from the gear box to the Sprockets is quite original and worthy of mention.

The final shaft protruding from the gear box carries a Bevel Wheel that meshes with a second Bevel Wheel mounted in the centre of a Rod that carries two Pulleys fitted with Rubber Rings. Each of these Rings normally is held in engagement with further Rings mounted on Pulleys that are secured to the shafts carrying the Sprockets (see underneath view of model). The two Rods carrying the Sprocket Wheels may be moved longitudinally in their journals and the frictional right angle gearing or "clutch" on each shaft can thus be engaged or disengaged. The steering column is connected by means of a series of levers to the shafts carrying the Sprockets, and by rotating the steering wheel either of the drums can be stopped at will and the snow motor thereby deflected to the right or left as required.

It will be apparent from the foregoing that the design of the model (which conforms accurately to the principles embodied in the actual motor) has formed no small task for its builder. Cole has been completely successful, however, in his efforts to reproduce an accurate model of the prototype.

An exceedingly well designed model of a steam lorry was submitted in Section B by M.H. Maufe. The model is illustrated at the foot of this page and it will be seen that it closely resembles a type frequently seen on the roads. Note should be made of the neat mechanism whereby the rear platform is tipped. The steering gear is also quite ingenious, and its design conforms closely to actual practice.



Meccano Steam Lorry fitted with tipping platform and Dunlop Tyres. The work of M. H. Maufe

"March" Competition, Overseas Section

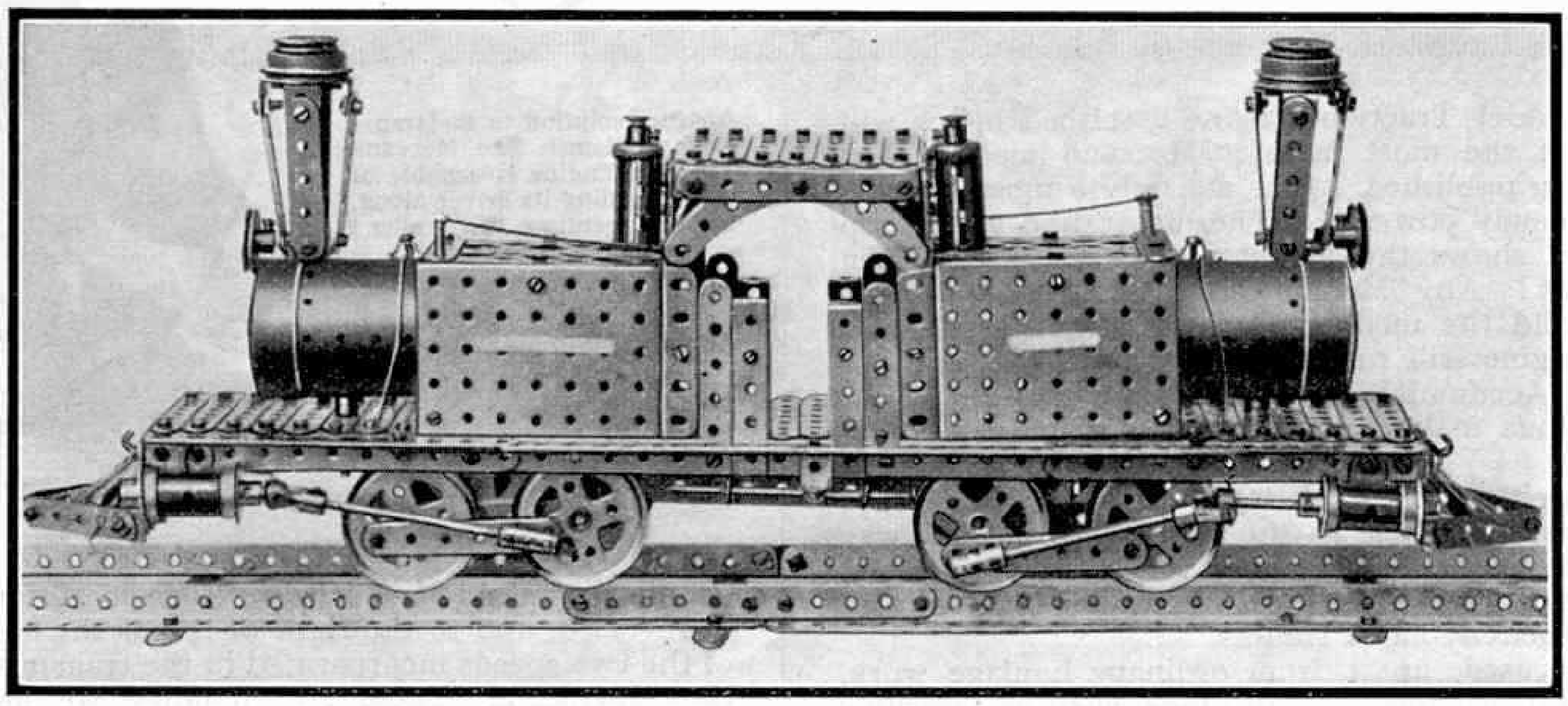
The prizewinners in the Overseas Section of the "March" Model-building Contest are as follows:—

FIRST PRIZE (Cheque to value £3-3s.): Francesco Cavallari Murat, Turin, Italy. SECOND PRIZE (cheque to value £2-2s.): Tony MacLachlan, Dunedin, Otago. New Zealand. THIRD PRIZE (cheque to value £1-1s.): P. Woodman, Teneriffe, Canary Islands.

SIX PRIZES, each consisting of Meccano products to the value of 10/6: B. Warner, Grahamstown, South Africa; Nelson Eustis, Alberton, South Australia; D. Miller, Caulfield, Melbourne; A. Pilgrim, Leederville, Perth; W. L. Bom, Weltevreden, Java, D.E.I.; K. Ritchards, Gsteig by Gstaad, Switzerland.

TWELVE PRIZES, each consisting of Meccano products to the value of 5/-: B. Churchill, St. Johns, Newfoundland; Paul Giry, Unieux, Loire; Albert Bombard Groslay, Seine-et-Oise; J. Giralt, Barcelona, Spain; Noel F. Brown, New Town, Tasmania; A. J. Smith, Montreal, Quebec; V. Lopes, Demerara, British Guiana; M. Wills, Sydney, N.S.W.; W. K. Bettesworth, Camps' Bay, Cape Town, S. Africa; Allan Boniface, Hawkes Bay, New Zealand; John S. Coombs, St. Clair, Dunedin; B. Sacks, Johannesburg, S. Africa.

SPECIAL COMMENDATION (Certificate of Merit and Standard Mechanisms Manual): L. C. Hill, Toronto, Canada; S. G. Budge, St. Sampsons, Guernsey; E. and P. Taylor, Toronto, Canada; Wayne Baker, Fontana, Calif, U.S.A.; A. Osborn, Sydney, Australia; C. Hilder, Toronto, Canada; A. Simonetti, Milan, Italy; Maxwell Gage, Auckland, New Zealand.



This model of "Josephine," an old Fairlie type engine, forms an interesting contrast with locomotives of the present day. It was constructed by T. MacLachlan

Models of buildings, towers, and other civil engineering subjects are comparatively rare in Model Competition entries. It is not impossible, however, to reproduce such objects with accuracy, as is proved by models of this type that we have already illustrated in the *"M.M."* F. C. Murat's prize-winning model is one of the best efforts in this direction that I have seen. The model is reproduced on page 832 of this issue and I am sure readers will agree that it is a very handsome one. The model is of "La Mole Antonelliana" of Turin, which is over 500 ft. in height and is claimed to be the tallest monument in the world. Every Meccano boy will appreciate the enormous amount of time and patience required to build a model of this description. The fastening of a thousand nuts on to a similar number of bolts is in itself no light task!

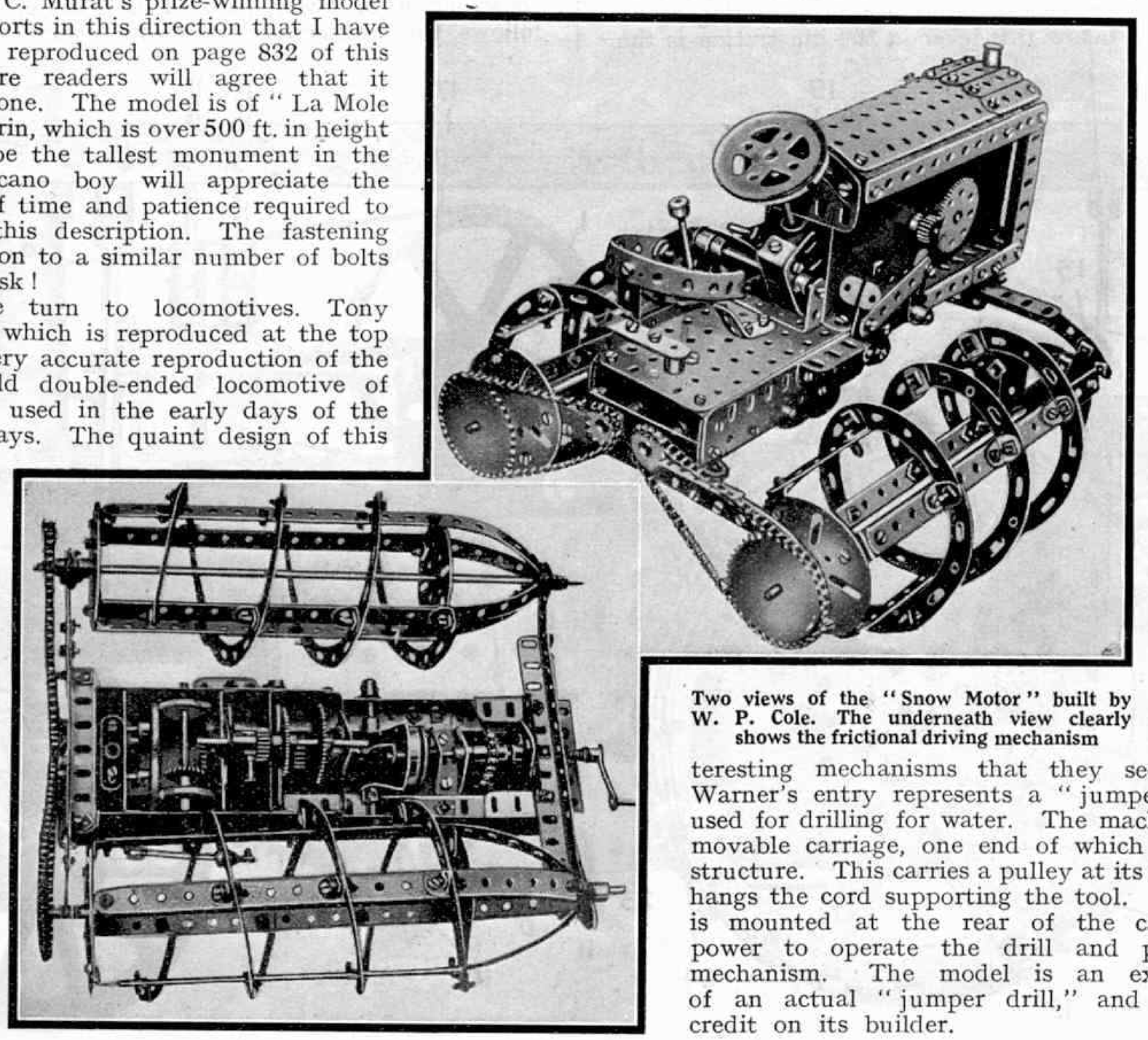
From towers we turn to locomotives. Tony MacLachan's entry, which is reproduced at the top of this page, is a very accurate reproduction of the "Josephine," an old double-ended locomotive of the "Fairlie" type used in the early days of the New Zealand Railways. The quaint design of this engine should appeal to those Meccano boys who are "locomotive mad" for it affords the opportunity of building two engines at once! In the actual engine steam was supplied from separate boilers to cylinders at either end of the main frame. The old "Josephine" used wood fuel, hence the capacious smoke stacks.

The model, besides being interesting on account of the novelty of its subject, is an excellent example of the use of the new Meccano Boilers and Sleeve Pieces, etc. The effect obtained by using these parts is certainly superior to the old method of building up the boiler and cylinders from a number of Strips and other parts.

P. Woodman chose a railway breakdown crane as the subject for his model. Although many cranes of this type are entered in the contests each month, Woodman's model stands out on account of its excellent design and neat construction. As in the prototype, the model includes a power unit that is capable of moving the whole crane backward or forward on the rails as occasion demands, independently of a separate locomotive. Woodman's crane is a fine piece of model-building and well deserves the prize that has been allocated to it.

Among other interesting entries received, I noticed a very fine model of a portable oil well driller entered by W. L. Bom. The model is very cleverly thought out and the constructional work is of a high order.

Nelson Eustis entered a well-built model of the Vickers-Vimy amphibian aeroplane in which that intrepid airman, the late Sir Ross Smith, made his great flight to Australia in 1919. The model is well proportioned and an idea of size and power has been cleverly brought out by its builder. Another entry worthy of mention is the dock crane submitted by K. Ritchards. The model has been designed on a type of crane commonly seen in docks and naval yards, and is mounted on a large gantry which enables it to be moved into various parts of the dock without interfering with the railway track. Ritchards has added further interest to his entry by arranging miniature rails and a number of engines and rolling stock around his crane, so making the complete scene most effective.

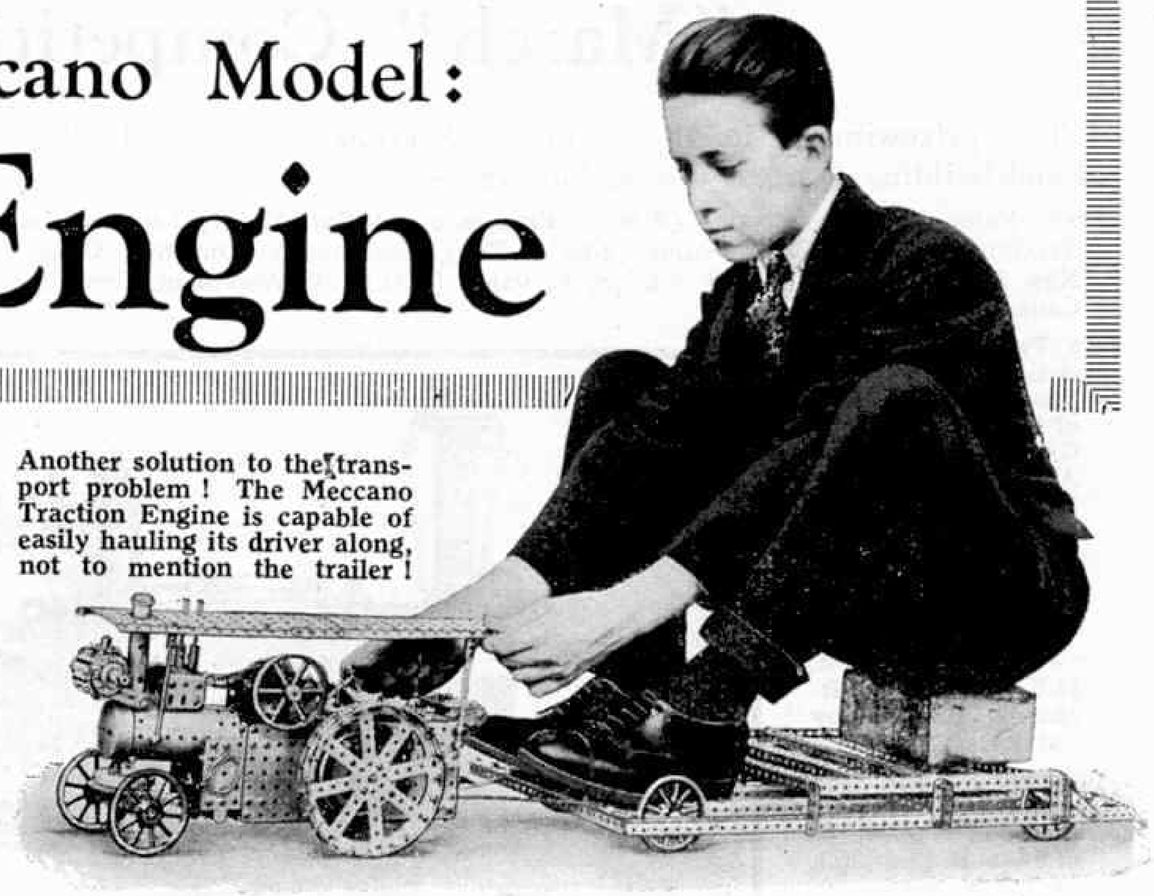


Two views of the "Snow Motor" built by W. P. Cole. The underneath view clearly shows the frictional driving mechanism

The entries received in the various Model-building Contests show that Meccano boys are by no means slow in reproducing interesting mechanisms that they see around them. B. Warner's entry represents a "jumper drill"—a machine used for drilling for water. The machine is mounted on a movable carriage, one end of which supports an upright structure. This carries a pulley at its upper end over which hangs the cord supporting the tool. A "donkey engine" is mounted at the rear of the carriage and supplies power to operate the drill and propel the complete mechanism. The model is an excellent reproduction of an actual "jumper drill," and reflects considerable credit on its builder.

Another fine new Meccano Model:

Traction Engine



Another solution to the transport problem! The Meccano Traction Engine is capable of easily hauling its driver along, not to mention the trailer!

WE believe the model Traction Engine described below will prove one of the most popular Meccano models that have yet been published. It is not only a most realistic model, but it is extremely powerful. The illustration at the top of this page actually shows the model pulling more than ten times its own weight! Any Meccano boy of average weight should be able to build the model and then take himself for a ride with it! The engine will run splendidly from the Meccano 4-volt 8 ampere-hour Accumulator, and the latter may be placed in the coal bunker, thus making the model an entirely self-contained power unit.

Steam traction engines, or road locomotives, have always interested boys almost as much as the more imposing railway locomotives. They are capable of pulling very heavy loads and are frequently to be met with on the great highways of the country hauling two or three heavily-laden trailers.

Steam tractors are used, apart from ordinary haulage work, for driving agricultural machinery of all kinds, such as threshing machines, ploughs, crushing mills, etc. Frequently they are equipped with a dynamo mounted on the front of the boiler and so arranged that it may be driven merely by placing a belt round a pulley on its armature and round the flywheel of the engine. Travelling showmen, for whom some of the finest traction engines have been built, often use the dynamo to supply the necessary power to drive as well as to illuminate their roundabouts or scenic railways, etc.

Particulars of the Controls

The various control handles in the model are all placed conveniently for easy operation. The steering gear, which, as in actual practice, consists of worm gearing and chain connection to the front axle, is operated by the hand wheel 4 (Fig. 1). Operation of the handle 5 applies or releases an external-contracting brake on the rear axle. Just below this lever in the illustration is the handle by means of which the Electric Motor is started, stopped, or reversed, and to the right of this is the handle by which either of the two speeds incorporated in the transmission may be brought into operation. These two handles are numbered 71 and 72 respectively in Fig. 3.

We would draw special attention to the manner in which the Electric Motor has been incorporated in the model. While it conforms to the general lines of the engine, the Motor takes up a minimum amount of space and allows ample room for the gearing, etc., and for the Accumulator.

In order to complete the realistic appearance of the model a miniature cylinder block, with valve chest and crankshaft, etc., is included, the crankshaft being driven from the Electric Motor. In addition, a representation of a dynamo is placed at the front of the boiler.

Every detail of the engine has been planned so that it can be built up as far as possible section by section, and no expense has been spared in preparing detailed illustrations that show the construction of every part of the model. Providing that he follows the instructions carefully, every Meccano boy should

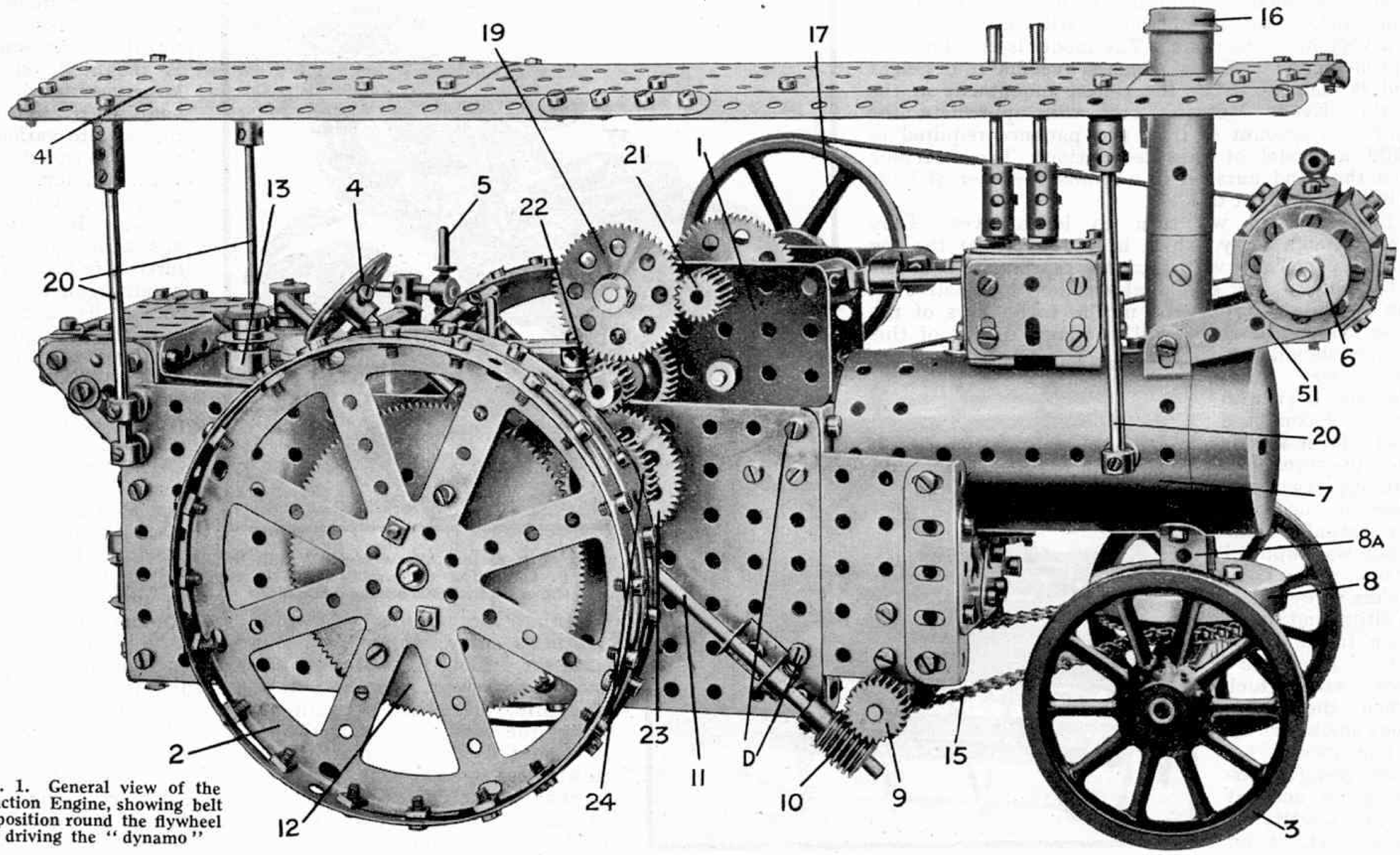


Fig. 1. General view of the Traction Engine, showing belt in position round the flywheel for driving the "dynamo"

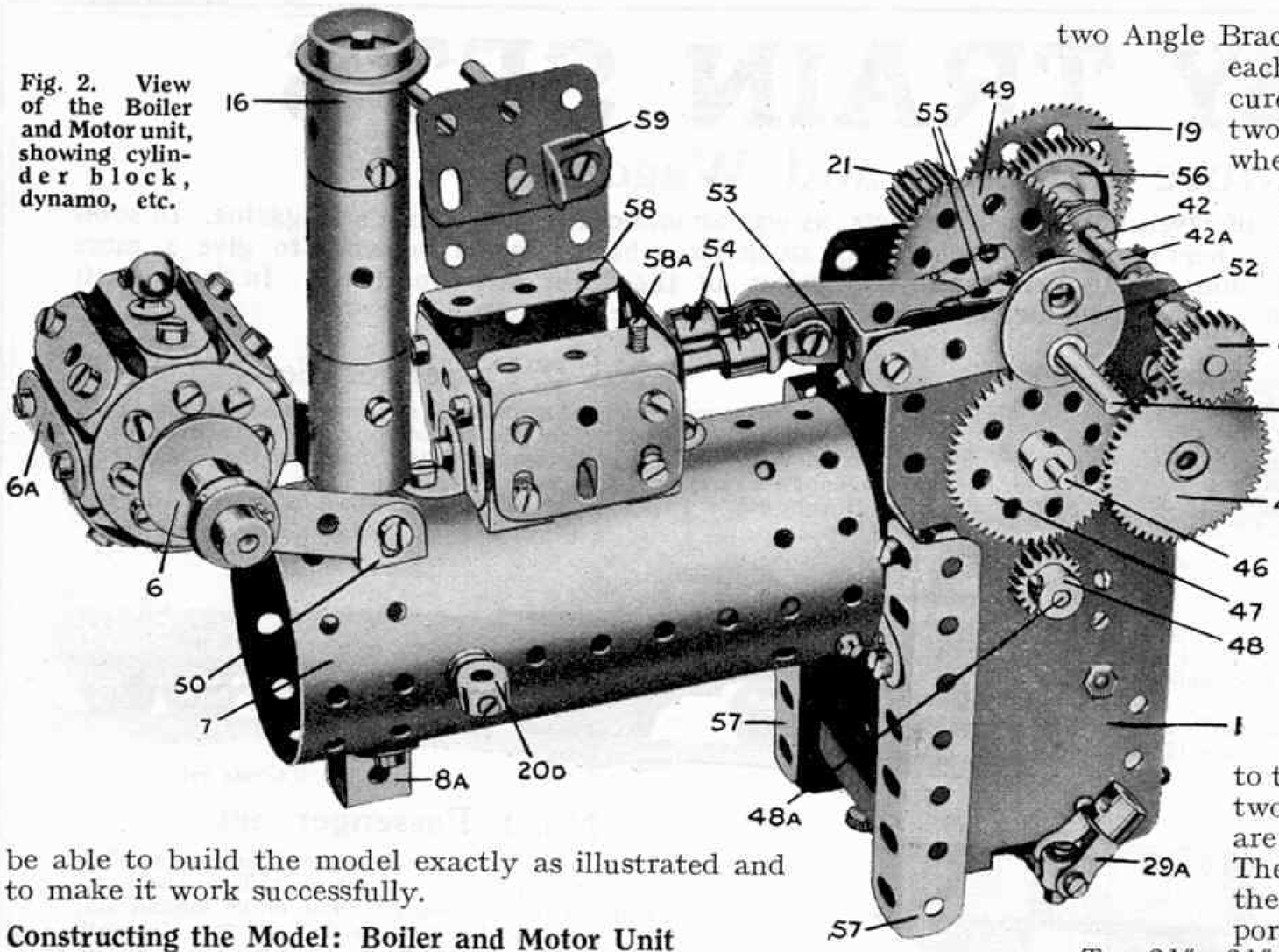


Fig. 2. View of the Boiler and Motor unit, showing cylinder block, dynamo, etc.

be able to build the model exactly as illustrated and to make it work successfully.

Constructing the Model: Boiler and Motor Unit

The construction of this portion, which embodies the main gear train controlling the travelling movements of the model, is shown in detail in Fig. 2. Two 3½" Angle Girders 57 bolted to the flanges of the Electric Motor form the supports by which the completed unit is secured later to the rear portion of the model.

A Boiler 7 with front end plate is bolted to the Girders 57 and carries on its upper surface the cylinder block 58, which is built up from six 1½" Flat Girders, eight ½" × ½" Angle Brackets, two 1½" Angle Girders and two 1½" × ½" Double Angle Strips. The sides of the block are connected to the back and front cylinder covers by Angle Brackets, whilst the top (consisting of two 1½" Flat Girders) is attached to the sides by means of the 1½" Angle Girders. The entire block is secured to the boiler top by means of two 1½" Double Angle Strips bolted to the bottom edges of the side Flat Girders, and also by two Angle Brackets.

The top of the cylinder block carries on the inside an Angle Bracket 59, in the hole of which one of the 2" Rods 54 is journalled. This Rod represents the piston rod and carries an End Bearing to which one end of a 2" Strip is attached pivotally by means of a nut and bolt. The other end of the 2" Strip is pivoted on the pin of the crankshaft 43. The latter is built up as follows: Two Couplings 55 are secured at right angles to two 2" Rods 43 (the Couplings should be fixed very securely on their respective Rods by employing two Grub Screws in each Coupling) and a ¾" Bolt is passed through their end holes to form the crank pin. The crankshaft is journalled in the Motor side plates in the centre of the top row of holes.

The valve rod is formed by the other 2" Rod 54 journalled in the end cylinder cover and also in an Angle Bracket secured by means of a bolt 58A to one of the 1½" Angle Girders of the cylinder block 58. This Rod carries an End Bearing that is attached rigidly by nut and bolt to a ½" Reversed Angle Bracket, which, in turn, is connected pivotally by a bolt and two nuts (see Standard Mechanism No. 262) to a Single-throw Eccentric 52 carried on the end of the crankshaft.

A "safety valve" composed of two Couplings carrying 1½" Rods (see Fig. 1) may now be mounted on the cylinder block as shown.

The chimney 16 (Fig. 2) is composed of three Sleeve Pieces placed end to end with the centre Sleeve Piece overlapping each of the other two by ⅜". A 3½" Rod passed lengthwise through the centre of the three Sleeve Pieces carries at one end a ¾" Flanged Wheel that forms the top of the chimney. The top and bottom Sleeve Pieces are held in place by means of bolts passed through them and inserted in the holes of new-style Collars carried on the 3½" Rod.

The dynamo is mounted on two 2" Strips secured to two Angle Brackets 50 (Fig. 2). It consists of two Bush Wheels each carrying seven Angle Brackets to which are secured 1½" Strips. A 2½" Axle Rod passed through the two Bush Wheels carries two ¾" Flanged Wheels 6, one wheel being placed on either side of the dynamo. A ½" loose Pulley also is placed on one end of the Rod and is spaced from the ¾" Flanged Wheel by two Collars, while a further Collar secured to the Rod on the outer side of the ½" Pulley holds the latter in position. The dynamo lifting hook is formed by a Handrail Support fitted to one of the 1½" Strips forming its frame.

Main Frame, Coal Bunker, etc.

The framework of the rear portion (Fig. 3) houses the control levers, rear axle, coal bunker, etc., as well as the 4-volt Accumulator from which the current supply is obtained.

Two 5½" × 3½" Flat Plates 62 overlapped four holes and bolted together form each side of the main frame. The rear end is composed of two 2½" × 2½" Flat Plates overlapped four holes and bolted to Angle Girders secured to the Flat Plates 62. Two 5½" Angle Girders 64 are bolted to the lower edges of the Plates 62 and are spanned by two 3" Angle Girders 39. Two 5½" × 2½" Flat Plates are secured to the Angle Girders 64 of the main frames. These plates form the floor of the body and support the Accumulator 13 (Fig. 1) carried in the rear portion of the model.

Two 2½" × 2½" Flat Plates 63 bolted to the front ends of the Plates 62 (Fig. 3) carry two 2½" Angle Girders to which are bolted Corner Brackets 65 connected in the centre by the 1" Triangular Plate 66 that carries an Angle Bracket 66A. The construction of the tool box 70 (Fig. 3) should be quite clear from the illustrations and does not require a detailed description.

A 6½" Rod 31 is journalled in the side Plates 62 and in 1½" Pulley Wheels 37, which are secured to the inside faces of the Plates to reinforce the bearings of the Rod. This Rod forms the axle for the rear road wheels, and is held in position by Collars placed against the bushes of the Pulley Wheels 37. The brake drum 30

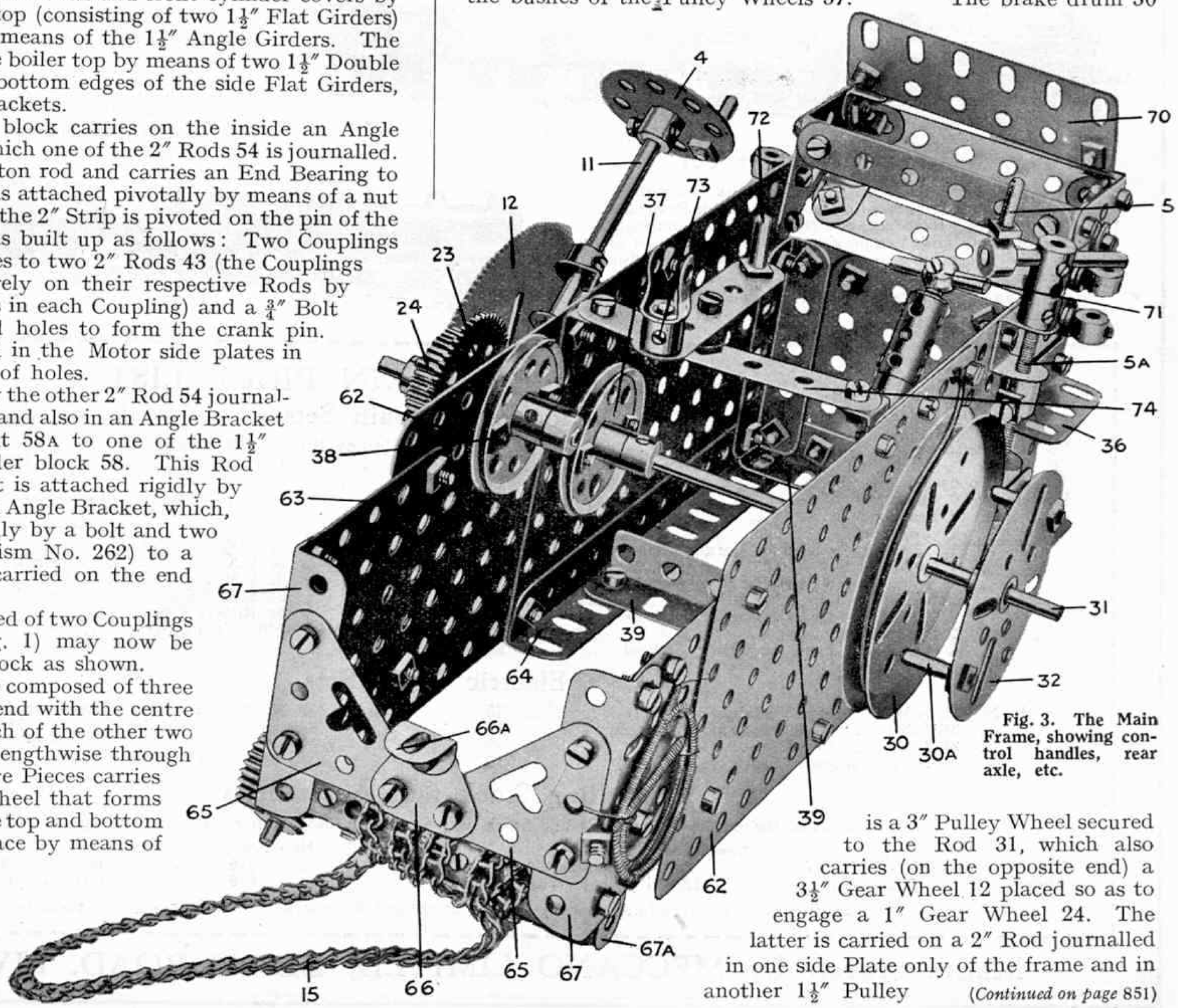


Fig. 3. The Main Frame, showing control handles, rear axle, etc.

is a 3" Pulley Wheel secured to the Rod 31, which also carries (on the opposite end) a 3½" Gear Wheel 12 placed so as to engage a 1" Gear Wheel 24. The latter is carried on a 2" Rod journalled in one side Plate only of the frame and in another 1½" Pulley

(*Continued on page* 851)

HORNBY TRAIN SETS

With More Coaches and Wagons

Alterations have been made in the contents of several Hornby Train Sets, as was announced in last month's Magazine. In some cases new rolling stock has been added, while in others replacements of rolling stock have been effected in order to give a more realistic appearance to the sets. These additions do not increase the prices of the train sets concerned. In fact, No. 0 Passenger Set is now reduced from 22/6 to 20/–. Ask your dealer to tell you all about the new sets.

No. 0 Passenger Set

No. 0 Goods Set

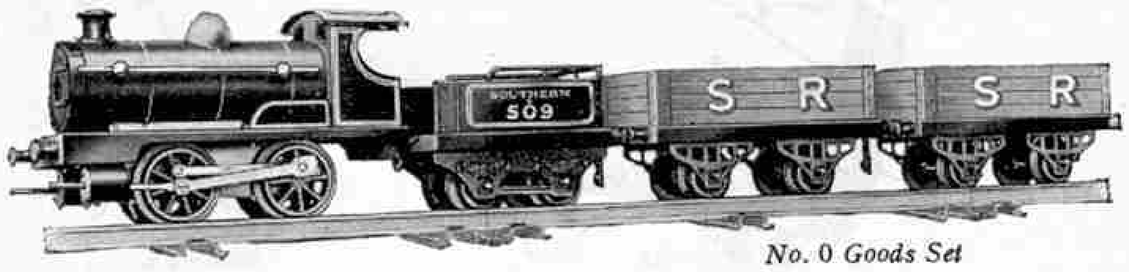
This set is improved by the addition of an extra wagon. It now consists of Locomotive (non-reversible) Tender, two Wagons and set of Rails. The Locomotive is fitted with brake mechanism. Gauge 0.

Hornby No. 0 Goods Set, complete, packed in strong cardboard box ... ... Price **17/6**

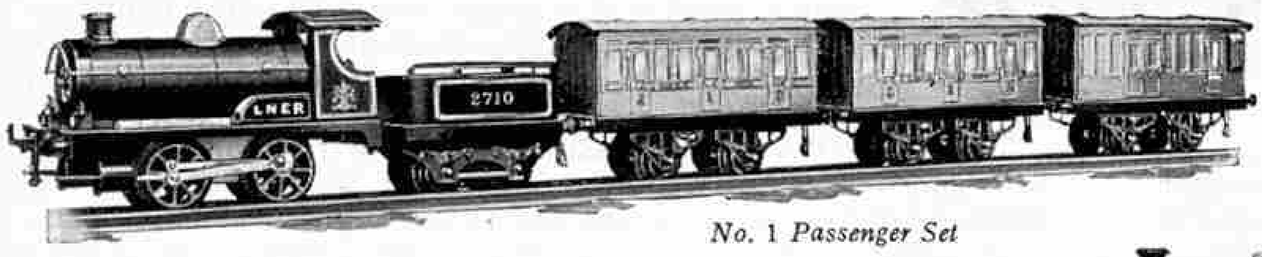
No. 0 Passenger Set

This set now contains Locomotive (non-reversible), Tender, Passenger Coach, Guard's Van and set of Rails. The Locomotive is fitted with brake mechanism, and the doors of the Coach and Guard's Van open. Gauge 0.

Hornby No. 0 Passenger Set, complete, packed in strong cardboard box ... ... Price **20/–**



No. 0 Goods Set



No. 1 Passenger Set

No. 1 Goods Set

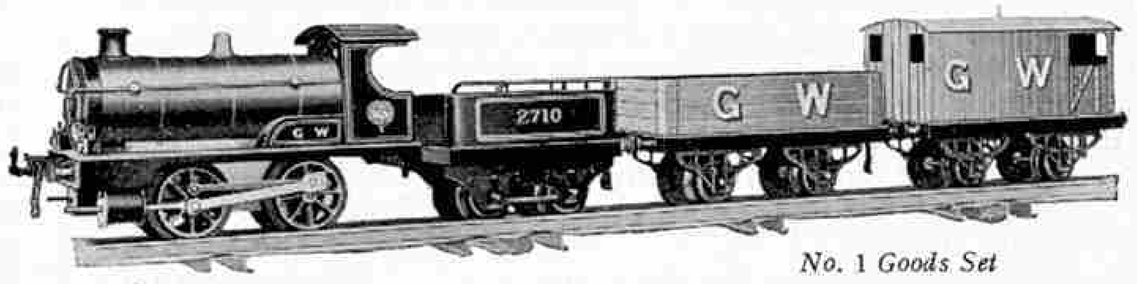
The revised contents of this set are Locomotive, Tender, Wagon, Brake Van and set of Rails. The Locomotive is equipped with reversing gear and brake mechanism. Gauge 0.

Hornby No. 1 Goods Set, complete, well boxed ... Price **20/–**

No. 1 Passenger Set

This set now consists of Locomotive, Tender, two Passenger Coaches, Guard's Van and set of Rails. The Locomotive is fitted with reversing gear and brake mechanism, and the doors of the Coaches and Guard's Van open. Gauge 0.

Hornby No. 1 Passenger Set, complete, well boxed. Price **25/–**



No. 1 Goods Set

No. 2 Goods Set

No. 2 Goods Set

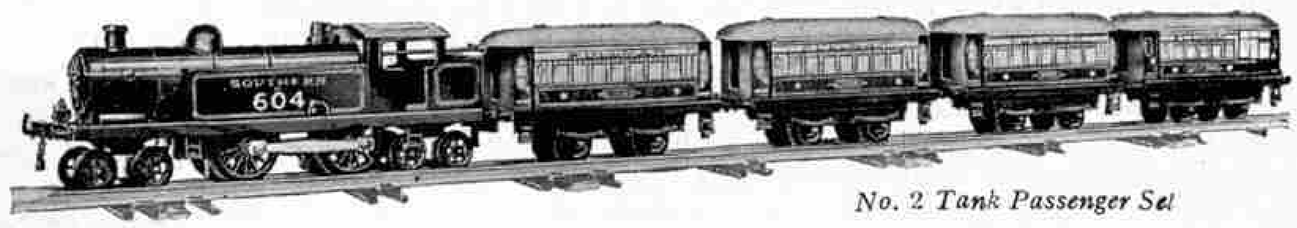
This set is much improved by the addition of a Brake Van. It now contains Locomotive, Tender, two Wagons, Brake Van and set of Rails. Gauge 0.

Hornby No. 2 Goods Set, complete, well boxed. Price **32/6**

No. 2 Tank Passenger Set

This set now contains a No. 2 Hornby Tank Locomotive, three No. 1 Pullman Coaches (in place of the three Passenger Coaches previously included), one No. 1 Pullman Composite (in place of the Guard's Van previously included), and set of Rails. The Locomotive is fitted with brake mechanism and reversing gear. Gauge 0.

Hornby No. 2 Tank Passenger Set, complete, well boxed. Price **40/–**



No. 2 Tank Passenger Set

1928 HORNBY TRAIN PRICE LIST

Clockwork Train Sets

No. M 1 Passenger Set	7/6
„ M 2 „ „	9/–
„ M 3 Goods Set	15/–
Hornby No. 0 Goods Set	17/6
„ „ 0 Passenger Set	20/–
„ „ 1 Goods Set	20/–
„ „ 1 „ „ fitted for Hornby Control	23/6
„ „ 1 Passenger Set	25/–
„ „ 1 „ „ fitted for Hornby Control	28/6
„ „ 2 Goods Set	32/6
„ „ 2 „ „ fitted for Hornby Control	37/6
„ „ 2 Pullman Set	50/–
„ „ 2 „ „ fitted for Hornby Control	55/–
Hornby No. 1 Tank Goods Set	22/6
„ „ 1 „ „ „ fitted for Hornby Control ...	26/–
„ „ 2 „ „ „	37/6
„ „ 2 „ „ „ fitted for Hornby Control ...	42/6
„ „ 2 Tank Passenger Set	40/–
„ „ 2 „ „ „ fitted for Hornby Control	45/–
„ „ 3c G.W.R. "Cornish Riviera"	60/–
„ „ 3c L.N.E.R. "Flying Scotsman"	60/–
„ „ 3c L.M.S.R. "Royal Scot"	60/–
„ „ 3c S.R. "Continental Express"	60/–
„ „ 3c Riviera "Blue" Train	62/6
„ Metropolitan Train Set C	55/–

Electric Train Sets

Hornby No. 3E G.W.R. "Cornish Riviera" (4-volt)	75/–
„ „ 3E L.N.E.R. "Flying Scotsman" (4-volt) ...	75/–
„ „ 3E L.M.S.R. "Royal Scot" (4-volt)	75/–
„ „ 3E S.R. "Continental Express" (4-volt) ...	75/–
Hornby No. 3E Riviera "Blue" Train (4-volt)	77/6
„ Metropolitan Train Set H.V. (100-250-volts)	110/–
„ „ „ „ L.V. (4-volt)	95/–

Rolling Stock and Accessories

The prices of the undermentioned Rolling Stock and Accessories have been revised and are now as follows:—

	New Price		New Price		New Price
Hornby Passenger Coach No. 0-1 ...	2/6	Seccotine Van	3/6	Pullman Coach No. 2-3 (Improved Design)	11/6
Riviera "Blue" Train Coach	12/6	Guard's Van	2/6	Goods Platform (Improved Design) ...	10/6

The prices of the remaining Hornby Rolling Stock and Accessories remain the same as previously

Manufactured by MECCANO LIMITED, BINNS ROAD, LIVERPOOL

"October" Model-Building Contest

ANOTHER SPLENDID OPPORTUNITY FOR MECCANO BOYS

THIS month's contest has been organised specially so that Meccano boys of all ages and with all types of Outfits may have an equal chance of carrying off the prizes listed in the centre of this page. No matter how small your model may be we want you to enter it in this contest, for very often the smallest models are the most interesting and obtain the largest awards.

In sending in your entry try and think out a model that is really new and original, but always remember that many of the highest awards in previous contests have been gained by competitors who have taken the simplest subjects for their models, the awards having been given for excellence of construction alone. On the other hand, models that were really novel in principle, but poorly constructed, failed to obtain a prize.

Many Meccano boys are restrained from entering Model-building Contests by the idea that the more parts put into the model that is being submitted, the bigger the chance one has of carrying off a prize. This is quite untrue. Every competitor has an equal chance, whether he owns a No. O or No. 7 Outfit. In fact the owner of a small Outfit has an advantage over the owner of a No. 7, in that any really clever idea contained in his model will stand out prominently, whereas in a larger and more elaborate model the good points are often spoilt by poor design and construction.

Again, many boys are deterred from entering on account of the question of age. There is no reason for this, however, for in addition to the entries being divided into separate Sections (see below) each individual entrant's age will be taken into consideration when awarding the prizes.

There are no entrance fees or forms, as will be seen from the instructions given below. All the competitor has to do is to obtain an illustration of his model (either photograph or drawing) and send it to this office. The judges will do the rest.

Before deciding on the subject for your entry try to visit a factory or an engineering works. You will find such a visit wonderfully productive of new ideas. Even a train or bus journey might furnish a fresh line of thought on which to work. Think out all the details carefully before starting to build the model and have a clear idea in your head of the subject you choose.

Overseas Competitors

Meccano boys residing outside the British Isles should make a special effort to enter this Contest. The Overseas closing date is extended over a period of three months after the Home Sections close, so you will have ample time in which to construct and submit your model.

Although entries from overseas competitors are grouped into one Section, the age of each model-builder will be considered when awarding the prizes. Start building your model now and help to make this a record contest!

Important Instructions

When you have built your model, have it photographed or, if you do not wish to do this, a clear drawing will do quite as well. When forwarding either photographs or drawings take care to see that your name, age and address, and the Section in which you are eligible, appear on the back of each sheet of paper. Neither photographs nor drawings need necessarily be your own work, but it is essential that the model itself is your own unaided work, both in design and construction.

If your model incorporates any special features that are not brought out well in your illustrations, be sure to include a description that will make everything clear to the judges. The descriptions, however, should be as short as possible. Some competitors, in their enthusiasm to explain the models, forward long descriptions. It is impossible of course for the judges to read them, as in these competitions they have to examine many hundreds of entries.

The entries will be divided into the following Sections: Section A, for competitors over 14 years of age residing in the British Isles. Section B, for competitors under 14 years of age residing in the British Isles. Section C, for competitors of all ages residing Overseas.

Address the envelope containing your entry "October" Model-building Contest, Meccano Ltd., Binns Road, Liverpool. Entries in Sections A and B must reach Liverpool not later than 30th November, 1928. Closing date for Section C; 28th February, 1929.

THE PRIZES

The Prizes to be awarded in Sections A and C are as follows:—

First Prize: Cheque for three guineas.

Second Prize: Cheque for two guineas.

Third Prize: Cheque for one guinea.

Six prizes, each consisting of Meccano products to the value of 10/6.

Twelve prizes, each consisting of Meccano products to value 5/-.

The Prizes in Section B are as follows:—

First Prize, Meccano products to value two guineas.

Second Prize: Meccano products to value one guinea.

Third prize: Meccano products to value 10/6.

Six Prizes, each consisting of Meccano products to value 5/-.

Twelve Prizes, each consisting of a Complete Instructions Manual.

A limited number of Certificates of Merit and complimentary copies of "Meccano Standard Mechanisms" Manuals will be awarded in each Section.

The No. 8 Fairycycle

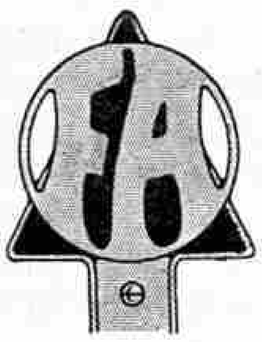
REGD TRADE MARK

is fitted with

Dunlop Balloon Tyres

There are "Fairycycle" models ranging from 39/6 to the one illustrated (No. 8 model) which has real Dunlop 2¼" section Balloon Tyres. This model has many features such as nickel plated rims, upturned handlebars, rim brake, cycle stand and carrier, and the price is 87/6.

A "Fairycycle" represents the best possible value in British Engineering skill—it is sound and safe and makes healthy exercise a pleasure.



"Fairycycle" Association

All "Fairycycle" owners are eligible for membership without fee. Every "Fairycycle" has a badge attached. The membership forms, which are given with every "Fairycycle," should be filled up and sent to Lines Bros. Ltd.

OTHER FAIRYCYCLE MODELS

No. 1, with tangent spoke wheels, ½" ribbed tyres, stand and carrier	39/6
No. 2, with stand and carrier, ⅞" ribbed tyres, rim brake, upturned handlebars, tangent spoke wheels	49/6
No. 3, De Luxe Model, with ball bearing wheels, 1" ribbed tyres, plated rims, etc.	59/6
No. 4, Super Fairycycle with ball bearings throughout and spring saddle, 1" cushion tyres	65/-
No. 6, Senior Model with 16" wheels, 1" ribbed tyres, ball bearings throughout	70/-
No. 7, as Model 6, but with 16" × 1⅜" pneumatic tyres	75/-

Fun on a Fairycycle

CHAPTER TWO

Last month we told you what fun Johnny and Mary got by playing at "Post Offices" and the great surprise Johnny gave Mrs. Smith by imitating the sharp rat-a-tat of the telegraph boy.

Well, before Mrs. Smith started to read her note, she gave Johnny some cake and gingerbeer. This made Johnny think how nice it would be if he could leave school and become a real telegraph boy.

It was not long before Johnny was on his way with an answer, and I can tell you he felt very important as he rode along with Mrs. Smith's note in his school bag. At every corner he rang his bell. The people he met must have known that he was on an urgent errand because they all got out of his way at once, except one old lady who was rather deaf. Johnny easily slowed up to let her pass, because the brake on a No. 8 "Fairycycle" is so powerful.

Just as Johnny was turning the corner of the road in which he lived, a big dog ran out and started to bark furiously. Johnny pedalled a little faster, and the dog ran behind still barking loudly.

He had read of the way in which wolves follow lonely travellers in Russia, and this dog looked so like a wolf that he pedalled on as hard as he could go. It was an exciting race, but Johnny won! He turned through the garden gate and pushed it behind him, shutting the dog outside and as he did so it gave a growl. Johnny delivered the reply safely to Mary at the kitchen window and she took it to Mother.

So you see Johnny made rare fun out of delivering a message—thanks to his "FAIRYCYCLE."

This is not the end of Johnny's adventures. We will tell you more next month.

The Red Triangle trademark on the "head" makes a genuine FAIRYCYCLE easily distinguishable

"Fairycycles" are made by

LINES BROS. LTD.

114, Morden Rd., Merton, S.W.19

Supplied by good-class Toy Dealers everywhere

Competition Page

"Sketchograms No. 2"

The sketchogram competition announced in our July issue proved one of the most successful contests we have ever held and in response to widespread requests we announce this month another contest on the same lines.

For the benefit of new readers it may be explained that the problem is to incorporate the two lines shown on the right of the sailor in a sketch in such a manner that they form one of its main features. Our artist's drawing shows how this may be done and it will be seen at a glance how the two lines form the framework of the sailor's left arm and left leg and part of his body.

Readers are asked to prepare original sketches in which these two lines are incorporated in a similar manner. The drawing of the sailor, of course, must not be copied, but there are no restrictions at all in regard to the nature of the drawing. It should be clearly understood that the position of the two lines in their relation to one another must not be altered, but the sketchogram as a whole can be turned upside down or tilted to any angle that may be desired. We may give competitors the hint that a bold and simple drawing in which the sketchogram lines are immediately obvious will have a better chance of success than a more elaborate drawing in which the lines are merely a minor feature.

In order that our younger readers may have a fairer chance of success the entries will be divided into two sections, A, for those from competitors aged 16 and over, B, for those under 16. The first and second best entries in each section will be awarded prizes of Meccano Products (or artists' materials, if preferred) to the value of £1-1s. and 10/6 respectively. In addition there will be a number of consolation prizes. Each competitor may submit as many entries as he wishes, but his name, age and address must appear on the back of each. Competitors who omit their ages will be placed automatically in Section A.

Entries must be addressed to "Sketchograms No. 2, Meccano Magazine, Binns Road, Liverpool," and must arrive not later than 31st October. Overseas closing date, 31st January, 1929. Entries cannot be returned unless a stamped addressed wrapper of sufficient size is enclosed.

My Favourite Type of Bridge

Among the larger engineering structures, bridges hold a very high place in the esteem of all "*M.M.*" readers. This applies to bridges in general and it has occurred to us that we should like to know which particular type of bridge is the most popular. This month we therefore offer prizes for the best short essays on "*My Favourite Type of Bridge and Why I Prefer It.*"

It should be understood clearly that the competition is not concerned with any *individual* bridge but with a *type*—cantilever, suspension, transporter, girder, etc. Each competitor should state which of these or other types of bridge he prefers and should then give as briefly as possible his reasons for the preference, such as ornamental appearance, ease of construction, strength, durability, etc.

Prizes of Meccano or Hornby Train goods, to be chosen by the winners, to the value of 10/6 and 5/– respectively, will be awarded to the senders of the best and second best narratives in each of the usual two sections: A for those aged 16 and over, B for those under 16. Every competitor must see that his name, age, and address, is given on the back of each entry. The actual entries should be written on one side of the paper only.

Entries must be addressed to "Bridge Competition, Meccano Magazine, Binns Road, Liverpool," and must reach this office not later than 31st October. Overseas closing date, 31st January, 1929.

COMPETITION RESULTS

Silhouettes No. 3. For once the Competition Editor has floored his readers! Although each of the silhouettes used in this competition was of a well-known advertising figure no entrant succeeded in submitting an absolutely correct solution. A great number of competitors, however, succeeded in identifying 17 of the figures, and accordingly the prizes have been awarded to those boys who sent in the neatest and most original efforts.

The following are the names of the successful entrants:—1. S. RICHARDS (Manor Park, E.12); 2. G. LUDLOW (Hastings); 3. C. KING (Glasgow); 4. S. A. MARSH (Chester); Consolation Prizes: F. L. BUSSEY (Cawood, Yorks.); E. EALES (Bath); E. FENN (Southend-on-Sea); R. HORTON (Ashford, Kent); J. REED (Harlesden, N.W.10); N. SCOTT (West Hartlepool); G. WEBSTER (Stamford); M. WILLIAMS (Neath, Glam.).

36th Photographic Contest. The subject of this competition was "A Transport Photograph," and some very fine efforts were submitted. The subjects covered practically every known form of transport, including the sledge and the ox cart.

The First Prize in Section A goes to F. G. CLEMENTS, of Luton, for a very fine study of tramcars on the Thames Embankment. This somewhat prosaic subject was treated in a most effective manner, and a really beautiful picture was produced. The Second Prize in Section A was secured by a photograph of a very novel subject, a wagon advertising beef suet drawn by a pair of oxen. The author in this case was G. SCHOFIELD (Sheffield).

One would hardly imagine North Wales to be the home of sledge transport, but those who know the district will need no telling that the industries of North Wales can produce some striking examples of the adaptation of olden day methods to modern requirements. KENNETH MARSDEN, of Southport, secured the First Prize in Section B with a snap of a team of horses drawing a sledge loaded with slates from the Rhyd-ddu quarries in North Wales. A 4-6-0 Great Eastern type locomotive of the L.N.E.R. was the subject of the entry that gained the Second Prize in Section B for T. COOPER, of Rugby.

Consolation prizes were awarded to A. NICHOLSON (West Kirby) and M. GOOD (Meols).

Competition Closing Dates:

HOME.	
Sketchograms No. 2	**31st October**
"My favourite type of Bridge"	**31st October**
OVERSEAS.	
Sketchograms	**31st October**
35th Photo	**31st October**
Silhouettes No. 3	**30th November**
36th Photo	**30th November**
Doublets No. 4...	**31st December**
37th Photo	**31st December**
Holiday Stories	**31st December**
Sketchograms No. 2	**31st January**
"My favourite type of Bridge"	**31st January**

OVERSEAS RESULTS

25th Drawing Competition. We have become accustomed to look for some really excellent work in an Overseas drawing competition, and the 25th competition with Captain Campbell's "Bluebird" car as the subject proved no exception to the rule. Indeed we feel almost justified in saying that the general average of the work submitted to this competition was higher than in any previous one. It is pleasing to note that the principal prizes have been gained by boys who have not previously been successful.

Many entries were carried out in colours and some sensational effects were secured, particularly where Captain Campbell's car was shown "at speed." Drawings and paintings of this type necessarily called for the exercise of imagination. Realising the difficulties of absolute accuracy in such circumstances, most of those who tackled the task preferred to concentrate on the presentation of an atmosphere of speed and they succeeded to a remarkabl degree. The task of judging the entries proved exceedingly difficult but eventually the following awards were made:—

First Prizes: Section A, D. A. WALKER (South Canterbury, N.Z.); Section B, W. G. FREEMAN (Bethlehem, O.F.S.); Second Prizes: Section A: I. MACDONALD (Victoria, Australia); Section B: N. G. BRIERLY (Auckland, N.Z.). Consolation Prizes: D. ADAMS (Sydney, Australia); P. M. BIND (Port Elizabeth, S.A.); McL. MORGAN (Sydney, Australia).

Gibbons' Catalogue

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10 Chili ...	...	3d.	25 ,,	...	3d.
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215 MONSTER PARCEL 215

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COLONIAL COLLECTORS RECEIVE PARCEL BY NEXT MAIL. **VICTOR BANCROFT, MATLOCK, Eng.**

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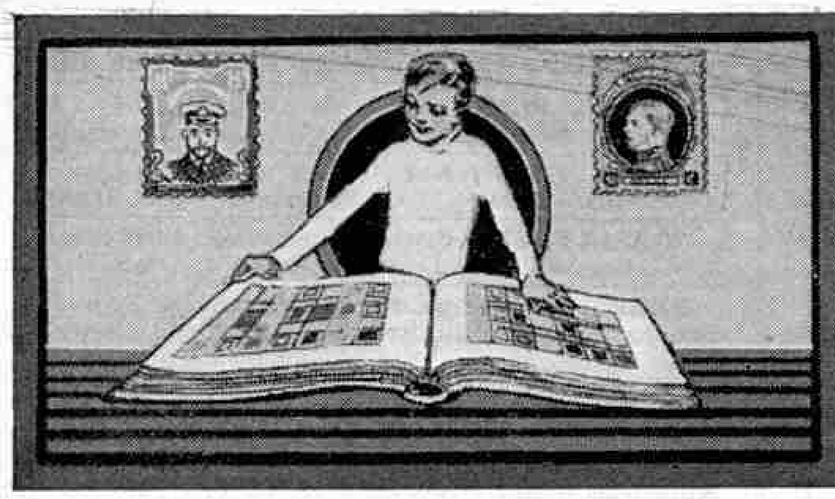
In addition, all purchasers of the Packet asking for approval sheets and sending 1½d. postage will be presented with two splendid sets—**8 MALAY** (tigers) usually sold at 10d. and **12 HUNGARY** (Turul—the mystic bird of the Magyars) catalogued 1/-. Send addresses of stamp collecting friends and receive an extra set free.
H. C. WATKINS (M. DEPT.), GRANVILLE ROAD, BARNET



Stamp Collecting

HOW TO COMMENCE THE HOBBY

AT this season of the year we always receive large numbers of letters from boys who are turning their thoughts to indoor amusements for the winter months and who want advice as to the adoption of stamp collecting as a hobby.

A Belgian railway stamp issued to frank parcels carried by rail

Stamp collecting resembles every other hobby in the fact that it presents certain difficulties to the beginner. It is here that a little friendly advice from an "old hand" is so very valuable, for many of these difficulties are more apparent than real and are cleared away by a few words of explanation. The beginner is usually started off in one of three ways—by the gift of an old collection, or of a packet of stamps, or by the enthusiasm aroused by the examination of a friend's album. In every case the question of equipment necessarily arises at once and a few words devoted to the album and the necessary accessories will no doubt prove helpful.

No boy need be discouraged from taking up stamp collecting by the thought that he cannot afford an album. Not only is a big and elaborate album entirely unnecessary for a beginner, but it actually increases his perplexities and discourages him by its vast expanse of unfilled space. The best thing to do is to buy a small album in which one or two pages are allotted to each country, with the title of the country and illustrations of one or two of its typical stamps printed at the head. In albums of this type the pages are ruled into spaces of suitable size and it is left to the collector to arrange his stamps on the page in any way that he prefers. The only important point is that the arrangement should be neatly made. No one can dispute the fact that a well-arranged collection is far more interesting to look at than a slovenly one, but apart from this the value of the collection, in view of a subsequent sale, is appreciably increased.

After a few hundred stamps have been collected and arranged in this manner, the best plan is to secure a larger album in which space is provided for each individual stamp. Albums of this kind are naturally more expensive but they are well worth their cost. Each page gives interesting historical information and illustrations of the stamps for which it provides accommodation.

The best type of album is one in which the pages are interleaved with fine tissue paper or in which spaces are provided on one side of the page only. Another type of album that will appeal particularly to the boy who is prepared to go to some trouble to arrange his collection to the best advantage is the loose-leaf album, in which he can insert as many pages as he desires for any particular country. The pages of such albums are usually blank, the headings of each country and the ruling of the pages being left to be carried out by hand. If desired, however, printed titles of countries ready for pasting in position may be obtained from any stamp dealer. The most important requirement of all is that the album should have a strong binding that will stand a good deal of wear and tear and that the pages should be of really stout and durable paper.

This Grecian issue commemorates the centenary of Lord Byron, the famous poet

The next essential is stamp mounts, or hinges as they are called. The beginner cannot be warned too strongly against the mistake of sticking his stamps into his album with gum, for in this case the stamps will be ruined. Stamp edging also is very unsatisfactory for many reasons. Good quality hinges cost only 6d. per thousand and there is really no excuse for making shift with something else.

French Morocco air post stamp first issued in 1922

The third essential for making a successful start is a catalogue to act as a guide in classifying the stamps of each country into their respective sets. Without a catalogue the collector is in much the same position as a sailor without a compass. There appears to be a mistaken impression that a catalogue is not necessary for a beginner, but this is quite wrong, and it is really better to spend a little money on a catalogue rather than on more stamps or even a larger album. A stamp catalogue contains details and illustrations of all postage stamps known to have been issued up to the date of publication. The 1929 editions will be out this month.

Having equipped ourselves with album, stamp mounts and a catalogue it only remains to consider exactly what stamps we are going to include in our collection. Some boys collect anything and everything, but it is far better to determine at the outset not to include any stamp in the collection other than those used for postal purposes. Let us consider for a moment what a stamp actually is. The simplest definition possibly is that it is a printed device used to denote that some tax or fee has been duly paid. Stamps may be classified under two headings, those that adhere to something else, known as "adhesive" stamps, and those that are printed or embossed on to paper ready for use, or "impressed" stamps. Each of these two types possesses subdivisions. There are "fiscal" stamps that have served to frank receipts, legal documents, bills, etc. Occasionally fiscal stamps are available for postage, such as, for example, certain of the existing British issues, which are inscribed "Postage and Revenue." There are the stamps used to represent fees paid on insufficiently stamped letters; registration stamps, air stamps, express letter stamps, newspaper stamps, parcels post stamps, official or service stamps that have been used on the correspondence of Government Departments, charity stamps, part of the price of which has gone to some charity while the remainder goes to the Postal Department in the ordinary

(*Continued on page* 851)

The recent South African triangular. This stamp is a revival of the earliest South African stamps issued by the Cape of Good Hope in 1853

The 1.25 lire issue of the Italian series, commemorating the centenary of St. Francis of Assissi

Portuguese commemorative celebrating Vasco da Gama's discovery of the route to the Indies

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What do these four jumbled words mean? If your answer is correct we will send you *absolutely* free any one of the following packets provided you ask to see our Approval Sheets and enclose four ½d. stamps for postage, etc. (6d. abroad).

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YOUR OWN SELECTION (many finds).

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NEW PICTORIAL GOLD COAST and 50 different Colonials with Cyprus, Malta, Palestine, Kenya, Bermuda, Turks, Morocco, Scychelles, B. Guiana, Ascension, South African Pictorials, 6d. free Bargain Variety Packet, 115 different, with Belgian Congo (Stanley), Greece Pictorial, Lebanon, Syria, Albania, Persia, Cochin, Luxemburg, Bulgaria, Cuba, Turkey, Montenegro, 6d. free. Ask for up-to-date Approvals and receive Gilbert & Ellice War Stamp Free.
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When you buy PACKETS you buy DUPLICATES.
I will send you a book of 1,111 different stamps from which you may select any 100 for 3/–.
BUY ONLY THOSE YOU REQUIRE.
1,111 H. HARDY, 285, Archway Road, London, N.6. 1,111

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IRISH ERRORS FREE
To every 4th Applicant for my **"Honest Value"** Approvals. Gifts to all others enclosing postage. **For 30 days only.** 100 diff. French Cols. 1/–. 50 diff. Port. Cols. 6d. **Postage extra** must be enclosed.
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Enclose Stamp.
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THE MIDLAND STAMP CO. LTD.,
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Stamp Collecting—(*continued from page* 849)

course. There are also commemorative stamps, but these usually are ordinary postage stamps celebrating with a special design some important public event or anniversary.

In the early days of stamp collecting it was the practice to collect every variety, but gradually, as the number of stamp issues became larger, the fiscals were discarded and then the impressed stamps. Even with postage stamps proper, that is, those that have been used to pay the fee for the carriage of correspondence from one place to another—stamps used on telegrams do not come within this category—there is a big field still to be covered, and some collectors now refuse to include anything other than simple postage stamps, including under this heading, air, charity and commemorative issues.

Having thus decided the principles upon which his collection is to be formed, the beginner can make a start. Stamps can be secured from many sources before financial outlay is necessary. Fathers, uncles, elder brothers, and their business friends can be very helpful, for most business houses are constantly in touch with firms abroad. Duplicates can be exchanged with stamp collecting friends, and stage by stage the pages of the album will begin to assume a business-like air.

At this stage the full fascination of the hobby will be felt, but at no time should the collector allow his desire to possess a numerically strong collection to over-rule the simple message of his stamps. The collector who knows the history of each of his stamps enjoys a greater sense of pride than he who knows only that his album contains several hundreds of stamps.

Next month we shall give practical advice upon the preparation of stamps for mounting, the actual method of mounting, and various other matters upon which the beginner requires help if he is to make best progress in his hobby.

Stamp Gossip

A Swedish Celebration

To celebrate the seventieth birthday of King Gustave V, Sweden recently issued a commemorative series of stamps, from which we illustrate the 15 öre value.

The complete series consists of five values, ranging from five to 25 öre. The design is the same for each of the stamps which were sold at a premium of five öre in order to provide funds for extension of Cancer Research work.

King Gustave was born in 1858 and ascended the throne in December, 1907.

Yun-nan Province Surcharge

Some time ago there came into my hands a pair of 2 cents (green) and two single 4 cents (bronze-green) stamps, of the 1922 general issue, that had been surcharged horizontally in black with the five Chinese characters reproduced below, a literal translation of these characters being "Yun-nan Province affix use," which being translated from the Chinese idiom means "ONLY for use in Yun-nan Province." Until very recently Yun-nan was using the same stamps as the rest of China. Why, then, this sudden change?

Inquiries have revealed a very interesting state of affairs. Many of the Chinese provinces mint their own money. There is a standard to which each Mint ought to conform, but in practice the money minted at the various Mints varies to a very remarkable degree. The percentage of silver in a dollar, which ought to stand at 87, has been known to fall below 45. Thus the dollar of any particular province not only varies in value from the dollar of any other province, but it also varies from itself from time to time!

Uprisings, earthquakes, famines and floods seem to be the all-important factors of these fluctuations in value. Thus we find that the unrest in the South of China, combined with a bad famine in 1925, has told very heavily on the silver currency of Yun-nan. So great was the fall in value of the Yun-nan dollar, that towards the end of 1926 it was worth only a fraction of the Northern province's dollar.

Certain "sharp" Chinese saw, in this state of affairs, a good opportunity to reap a small fortune. They set to work and

用貼省滇限

systematically bought stamps in bulk from Yun-nan post offices—paying for them with Yun-nan dollars. The stamps were sent up North, where they were sold—the buyers paying for them in Northern dollars! A very paying game for those Chinese concerned, but they reckoned without the Post Office. The sharp practice was soon discovered, and a stop was put to it by having those stamps destined to be used in Yun-nan so surcharged that they could not be used elsewhere. I am informed that the whole set to $2 has been surcharged in this way.

China is a land of many surprises, and it would be hard to imagine a more curious state of affairs than that set out above. Again China takes the biscuit!

(Gordon A. Clayton, in *Stanley Gibbons' Monthly Journal*).

* * * *

West Australian Centenary Commemoratives

To commemorate the centenary of the first permanent settlement in Western Australia, founded by Captain Fremantle at the mouth of the Swan River on 2nd May, 1829, the West Australian Ministry has decided to issue a special commemorative stamp. This issue probably will be confined to one denomination, 1½d., and the design will include the black swan that was used as the standard design for all West Australian stamps other than the high values of the issues subsequent to 1902. It is probable that the quantity of stamps issued will be limited to ten million, and the whole of the work, including the cutting of the dies and the printing, will be done within the Commonwealth.

There is a possibility of a new Commonwealth design making its appearance in the near future. In connection with the International Philatelic Exhibition, to be held at the Melbourne Town Hall at the end of this month, a prize has been offered for a design suitable for a Commonwealth postage stamp. The winning design will be considered by the Postal Authorities and may be adopted for use later.

Traction Engine—(*continued from page* 843)

38 bolted to the Plate. This 2" Rod is held in position by a Collar secured against the bush of the 1½" Pulley. It carries in addition to the Gear 24, a 57-teeth Gear Wheel 23 that engages the ½" Pinion 22 (Fig. 1) of the Motor unit. The Gear 23 (Fig. 3) is spaced from the frame Plate 62 by its boss and several Washers, so as to give clearance for the steering column 11.

External-contracting Brake

A Threaded Pin 5 (Fig. 3) is secured in a Collar on a 1½" Rod and the latter is passed through the end of a Coupling in which is carried a 3½" Screwed Rod 5A journalled in two Double Brackets bolted to the frame Plates as shown. The Screwed Rod carries a Threaded Boss between the Double Brackets, and is retained in position by a Collar secured to its lower extremity.

It is important to note that the Threaded Boss is free on the Rod 5A. The brake cord is attached to a bolt on the frame (see Fig. 3) thence passed round the brake drum 30 and secured to the Threaded Boss carried on the Screwed Rod 5A. On turning the handle 5 the cord is tightened on the brake drum or released according to the direction of rotation of the handle 4.

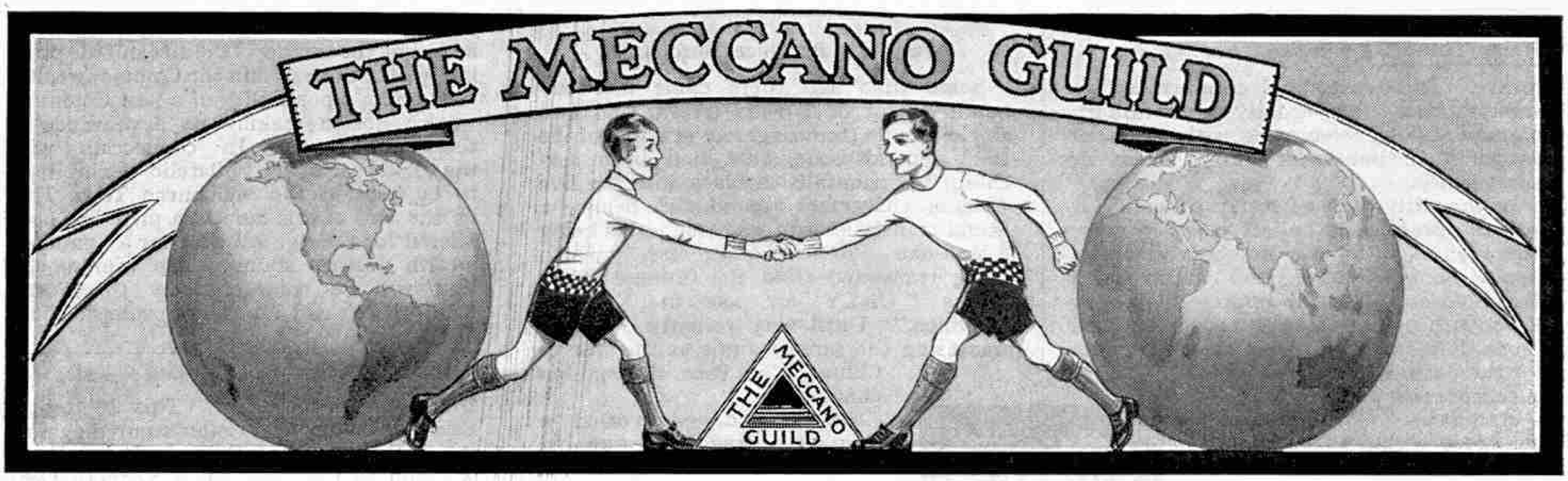
When this stage of the construction has been reached, the Motor unit (Fig. 2) may be secured to the rear portion (Fig. 3) by bolts passed through the Angle Girders 57 of the Motor unit and the end holes of the frame plates 62 (Fig. 3) as shown at "D" in Fig. 1. The lower surface of the Boiler is bolted to the Angle Bracket 66A (Fig. 3). The two units are thus held securely in position.

The remainder of the instructions for building the model will appear in next month's "*M.M.*" The illustrations that will be included in that number are as follows: plan view, showing crankshaft and gearing, etc.; underneath view, showing steering gear and brake; underneath view of roof.

Parts Required to build the Meccano Traction Engine:—

4	of No.	1B	3	of No.	21	1	of No.	80A
6	" "	4	5	" "	24	18	" "	94
1	" "	5	2	" "	25	1	" "	95
6	" "	6	3	" "	26	1	" "	103D
13	" "	6A	1	" "	26A	2	" "	103G
2	" "	9	1	" "	27	6	" "	103H
4	" "	9B	4	" "	27A	1	" "	109
2	" "	9C	1	" "	27B	1	" "	111
4	" "	9D	3	" "	31	10	" "	111C
4	" "	9F	1	" "	32	2	" "	114
6	" "	10	248	" "	37	5	" "	115
6	" "	11	6	" "	37A	1	" "	116A
33	" "	12	15	" "	37B	4	" "	118
1	" "	13A	31	" "	38	1	" "	125
1	" "	14	1	" "	45	4	" "	133
1	" "	15	4	" "	48	2	" "	136
9	" "	16	7	" "	52	1	" "	137
1	" "	16A	7	" "	58	1	" "	162
6	" "	17	28	" "	59	3	" "	163
3	" "	18A	11	" "	63	1	" "	164
1	" "	18B	1	" "	64	1	" "	165
2	" "	19A	4	" "	72	2	" "	166
1	" "	19B	3	" "	77	1	" "	170
3	" "	20B						

1 4-volt Electric Motor
1 4-volt 8-amp. Accumulator



With the Secretary

The New Session

In forming plans for the new session it is very important not to lose sight of the necessity for publicity. A Meccano Club cannot attain its full sphere of usefulness unless it has the support of local residents, and this support cannot be obtained without an effort. It is my experience that large numbers of people have practically no idea of the work of Meccano Clubs, and quite naturally this ignorance leads to indifference. The best remedy for this state of affairs is to persuade people to visit the club and see its members actually at work. As a preliminary it is an excellent plan to prepare a circular letter explaining briefly the objects for which the club stands and the nature of the work it carries out. The letter should conclude with a cordial invitation to visit the club on a certain date. This letter should be printed if possible, but if the expense is found too great it may be duplicated cheaply and easily by "jellygraph." A copy of the letter should then be sent to local residents who are likely to be in sympathy with boys' hobbies.

It is quite probable that many of the recipients of the letter will merely read it through and then throw it away, but even in such cases they have been made aware of the existence of the club and this knowledge may bear good fruit later. On the other hand a certain proportion of people will be interested to hear of the club and will pay it a visit on the date mentioned, out of sheer curiosity to see what really takes place. It then becomes of the utmost importance to make this Visitors' Night a success. The utmost endeavour should be made to secure a full attendance of members and to prepare an evening's programme that will really look attractive. A careful record should be made of the names and addresses of people who visit the club in this manner and invitations should be sent to them regularly on the occasion of exhibitions or whenever the club has anything of unusual interest on hand. A little care in this respect will almost inevitably result in securing good friends, whose influence may be valuable in later stages in smoothing over difficulties or in obtaining privileges for the club.

A Hint to Model Railway Sections

Many of the larger Meccano Clubs have a special section devoted to Hornby Trains and Model Railway working generally, under the guidance of a sub-Leader. To such sections the announcement that appears in the present issue regarding the formation of the "*Hornby Railway Company*" will be of particular interest, and I strongly advise their Leaders to write immediately for full particulars. I am convinced that if such railway sections form themselves into official Branches of the Hornby Railway Company the scope and interest of their miniature railway operations will be very largely increased.

Special Merit Medallions

Leaders are reminded that recommendations for Special Merit Medallions for the summer session should be sent in at the earliest possible moment. Supplies of club membership cards and subscription cards are now available and secretaries are requested to apply for them immediately.

* * * *

Meccano Club Secretaries
No. 14. H. Rutherford

Our photograph shows Harry Rutherford, the energetic secretary of the Larne Meccano Club. Although this club was only affiliated as recently as 23rd December, 1927, it has already proved itself full of vitality. It is fortunate in the possession of a really practical and well-planned club room and a well-fitted workshop for which it is indebted to its enthusiastic Leader, Dr. Killen.

I regret to announce that it has been necessary to close down the St. Mary's (Newington Butts, London) M.C. on account of the removal from the district of the Leader, Mr. G. Treves. This club has been in existence since early in 1921 and has had a notable career. In 1923, only a little more than two years after its foundation, it attained the distinction of being the largest Meccano club in the world, a position that it maintained for a considerable period. Under the skilful guidance of Mr. Treves, who was its founder as well as Leader, the club has always been notable for good work, its exhibitions being particularly successful. Fortunately it is probable that the Guild will still benefit from the disinterested work of Mr Treves, for he hopes to find some means of continuing in the Epsom district, in which he now resides.

* * * *

The Holy Trinity (Barnsbury) M.C. will hold their annual exhibition in the Holy Trinity Parish Hall on the 26th and 27th of this month. This will be the tenth annual exhibition held by this club, which was the first to be affiliated with the Guild, and a special effort is being made to celebrate the occasion worthily. A more than usually extensive display of Meccano models, fretwork, etc., is being prepared, and a special attraction will be a model railway layout in which the Hornby Train Control System will be a prominent feature. Officials and members will be very glad to welcome any Meccano enthusiasts and particularly members of other Meccano Clubs.

Proposed Clubs

Attempts are being made to form clubs in the following places, and boys interested should communicate with the promoters, whose names and addresses are given below :—

AUSTRALIA.—Jack Munro, Rowley Street, Brigton-le-Sands, Sydney, Australia.

BANGOR.—Norman Owen, "Undercliffe," Glynne Road, Bangor, N. Wales.

BURNLEY.—A. C. Nutter, "Lyndene," Fairholme Road, Towneley, Burnley.

CARDIFF.—Mr. W. Grey, 5, Plasturton Place, Canton, Cardiff.

CHERTSEY.—R. Burtenshaw, 140, Eastworth Road, Chertsey, Surrey.

CLUB NOTES

Herne Bay Meccano and Hobbies M.C.—A Race and Sports Evening at the Kent Coast College was so successful that a second meeting was held, the various events being very keenly contested on both occasions. A Cricket Match between the club and the College resulted in a win for the latter by 62 runs to 25. Visits to the Herne Bay Water Tower and the local Gasworks proved interesting, while the members thoroughly enjoyed both a well-organised Treasure Hunt and a Paperchase over a course of nearly nine miles. The Club Magazine continues to be a valuable and interesting feature. Club roll: 49. *Secretary*: Clifford W. Russell, 4, Clifton Villas, Herne Bay, Kent.

King Edward's High School (Birmingham) M.C.—School examinations shortened the summer session, but when these were over preparations for a record winter were begun. An interesting programme of Model-building Contests, Motor Chassis races and Lectures has been arranged, while it is hoped also to establish a permanent Model Railway. Club roll: 15. *Secretary*: David H. Lewis, The Mount, Bilston, Staffs.

Polsloe Rangers (Exeter) M.C.—Members are showing keen interest in Football and it is hoped to run two teams. The Hornby Trains owned by the club were recently taken to the local Children's Hospital and the patients were delighted by an exhibition of their running powers. Club roll: 15. *Secretary*: W. Bastin, 190, Pinhoe Road, Exeter.

South Dublin M.C.—A Sharp Eyes Contest, in which members were asked to find given phrases in newspapers, was a great success, one member describing it as the best competition yet held. A demonstration of the working of the Typewriter provided another interesting evening. A visit to the Zoo proved very popular and many interesting snaps were taken, the elephant being the favourite subject. An enjoyable Games Evening brought the summer session to a close. A Club Magazine is to be established. Club roll: 8. *Secretary*: G. M. Foley, 44, Eaton Square, Terenure, Co. Dublin.

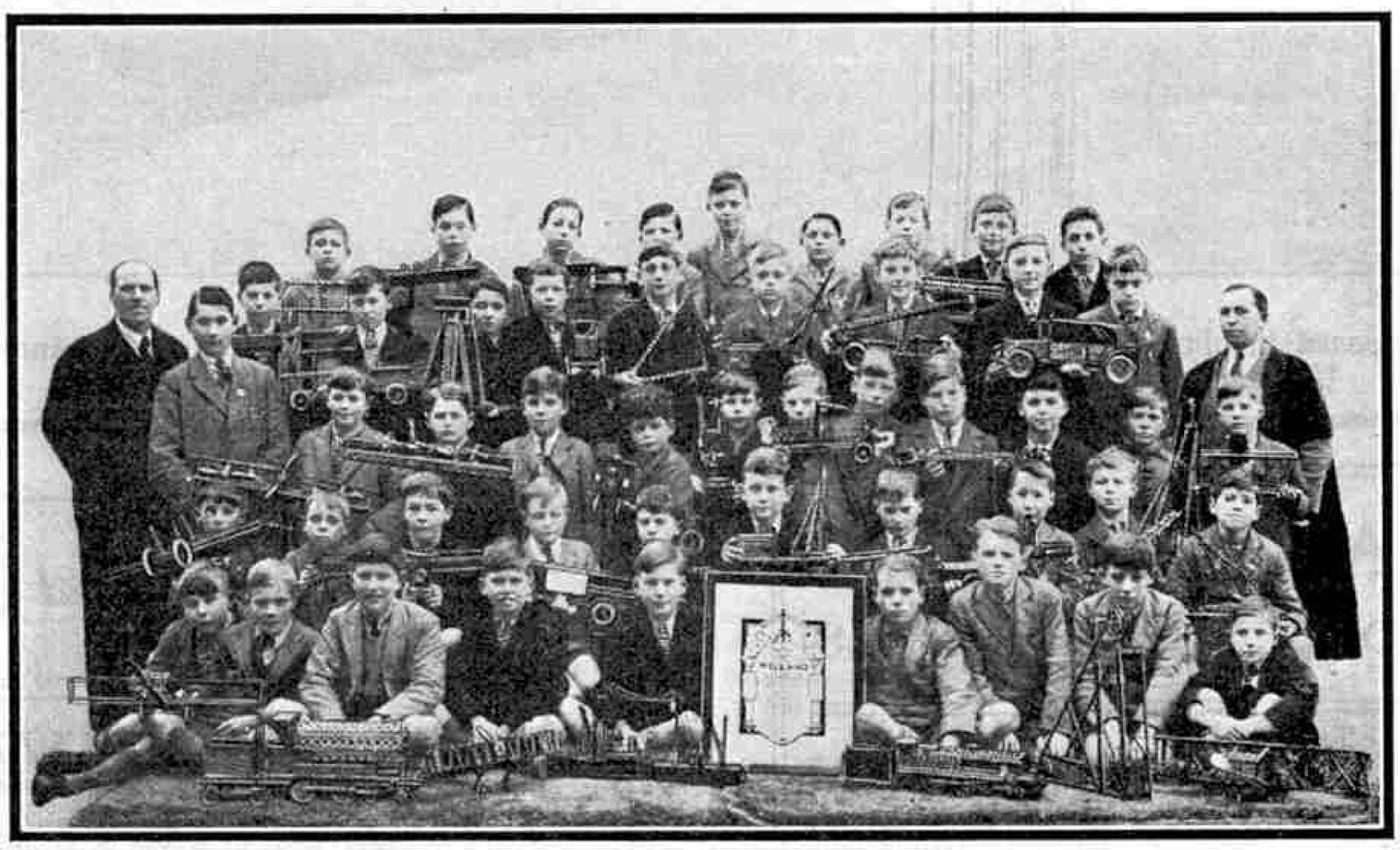
Stanstead M.C.—Model-building is the most popular feature, recent models including a Racing Car, Transatlantic Seaplane, Two-seater Car, a Locomotive and a Swing Boat. An Aero Section has proved a great success, models capable of excellent flight being produced. The models and aeroplanes were shown at the club's Exhibition, when prizes were awarded for the best, and also for the best collections of Stamps, Birds' Eggs and Flowers. A new Club Room has been secured. Club roll: 11. *Secretary*: G. T. Haselden, Bank Cottages, Stanstead, near Sevenoaks, Kent.

St. Albans M.C.—The membership shows a decided increase and the attendance is much more satisfactory. An interesting syllabus is being followed and includes Model-building, Hornby Train Evenings, Wireless and Games Nights, and Novelty Evenings. The Library is popular and an interesting feature is the Meccano Parts "Library," which is always well patronised. A recent visit to a Rubber Works was enjoyed. Club roll: 26. *Secretary*: A. H. Powell, 5, Alma Road, St. Albans.

Weymouth Central School M.C.—A most enjoyable visit was paid to Portland Bill, where the numerous Derricking Cranes aroused great interest. Eighteen members were conducted over the Lighthouse and were greatly impressed by the 3-ton lamp floating on quicksilver. Games Competitions are frequently held. Eight members with the Leader recently set out for a Cycle Run and Treasure Hunt. After many exciting episodes the Treasure was discovered and a visit to Dorchester concluded a 30-mile run. An interesting visit was paid to the submarine H.44, and guides explained all the wonders of this craft. Club roll: 22. *Secretary*: R. Mogg, 26, Chelmsford Street, Weymouth.

Albert Village M.C.—Has proved very successful in a full fixture list of cricket matches. Members have been invited to provide a display of models for a local dealer's store at Christmas, and preparations are being made for a good show. Club roll: 21. *Secretary*: L. C. Adey, 239, Occupation Road, Woodville, Burton-on-Trent.

Wyggeston Grammar School M.C.



The Wyggeston Grammar School Meccano Club was affiliated with the Guild in January 1926 with a membership of 41. It has flourished greatly under the skilful Leadership of Mr. G. Reynolds, and there are now more than 70 on the roll. As our photograph indicates, Model-building is a very prominent feature, and it is a rule that on exhibition days every member must produce a model of his own construction.

Norbury M.C.—A Printing Press has been secured and the Magazine is now to be published monthly. A Whist Drive and Dance has been arranged in order to raise funds for the purchase of new type. Mock Trials have been introduced and are proving highly successful, while a Bridge Building Competition was keenly contested. Club roll: 21. *Secretary*: A. F. Young, 21, Stanford Road, Norbury, S.W.16.

Northwood M.C.—The last meeting took the form of a Flower Show and Motor Race, the latter being won by a clockwork chassis with two motors. The club recently assisted at a Garden Fete in aid of the National Children's Home and Orphanage by managing the sideshows, and raised £5 out of a total of £17 realised. Club roll: 15. *Secretary*: Alan S. Whiddington, Pencarrow, Northwood.

Whitgift Middle School M.C.—The Exhibition was well attended and the numerous models attracted much attention. A Derrick and an Electric Locomotive carried off the chief prizes. Interesting visits have been paid to the Eastleigh Works of the Southern Railway and to Peak Frean's Biscuit Factory. Club roll: 29. *Secretary*: T. F. Brockes, 14, Addiscombe Court Road, East Croydon.

The Mall School M.C.—Two outings were held during the summer, one to the Zoological Gardens and one to Oxshott Woods. A tracking contest was organised after tea. A Concert held in the school gym. proved highly successful and was very well attended. Club roll: 27. *Secretary*: G. O. Mills, Keswick House, 60, Waldegrave Park, Twickenham. Middlesex.

Guildford M.C.—Is making splendid progress. At an Exhibition held some time ago the models displayed were of a very high standard, and a Motor Chassis loaned from Headquarters attracted much attention. Several members have made similar models and introduced variations. The club re-opened for the current session with an Exhibition and Social, and a Concert is to be held shortly. Club roll: 175. *Leader and Secretary*: Mr. Geo. W. Bartlett, 4, Friary Street, Guildford.

Victoria (Glasgow) M.C.—The first annual sports were held on the moors at Duntocher. This was a joint meeting with the Morison Memorial M.C. and about fifty members were present, Mr. Fraser, Leader of the Morison Memorial M.C. taking charge. The various races were keenly contested. The club now has a printing machine and prints its own announcements and leaflets. Club roll: 55. *Secretary*: Henry C. Thompson, 4, Montgomerie Gardens, Scotstoun, Glasgow.

Liverpool M.C.—An energetic Leader has been secured. The club appears to be on a promising basis, but new members are required. The Leader is also anxious to secure a good club-room and anyone who can assist in this direction is asked to communicate with him. Leader: Mr. Cyril Taylor, 30, Haddon Avenue, Orrell Park, Aintree, Liverpool.

Bradford M.C.—A special Exhibition is being held in the club room, Toller Lane, on 6th October, to be opened at 3 p.m. It is hoped that the members will all bring their friends along on this occasion. A splendid display of models has been arranged. Leader: Mr. A. L. Schofield, 16, Fairbank Terrace, Manningham, Bradford.

Australia

Swastika (Port Pirie) M.C.—Model-building is popular and many fine models have been brought to the club. The models set in recent weekly competitions have included Stationary Engines, Cranes and Boats. Excellent examples were presented for judging, the marks given being carried forward to a quarterly total. Club roll: 14. *Secretary*: Ronald Wood, c/o Mrs. H. Green, P.O. Box 20, Port Pirie, S. Australia.

Trinity Grammar School (Sydney) M.C.—Model-building and lectures have been the chief activities of this club, and two interesting lectures entitled "*Bridges*" and "*The Lewis Gun*" were greatly enjoyed. Mr. Bellingham, who lectured on the Lewis Gun, brought a specimen with him and demonstrated its action by taking it to pieces and re-assembling it. Club roll: 10. *Secretary*: H. Hauptmann, 3, Henson Street, Summer Hill, Sydney, N.S.W., Australia.

Hobart M.C.—Has been fortunate in securing Mr. Frank Wills, a well-known engineer, as club Leader, and now meets in a room at the local Y.M.C.A. The syllabus includes Model-building, Games, Lectures and visits to various places of interest. Debates also are popular, two on "*Aeroplanes v. Motors*" and "*Model Railways v. Meccano*" being very keenly contested. Model-building contests between the two sections "Bolts" and "Nuts" are held every six weeks, a shield being awarded to the side having the most marks at the end of the session. An Exhibition and Fair was opened by the Tasmanian Premier, the Hon. J. C. McPhee, M.H.A., and was attended by about 150 visitors. The sum of £5 18s. 3d. was raised and is to be used in the purchase of a Club Meccano Outfit. Club roll: 21. *Secretary*: F. Downie, 50, Letitia Street, N. Hobart, Tasmania, Australia.

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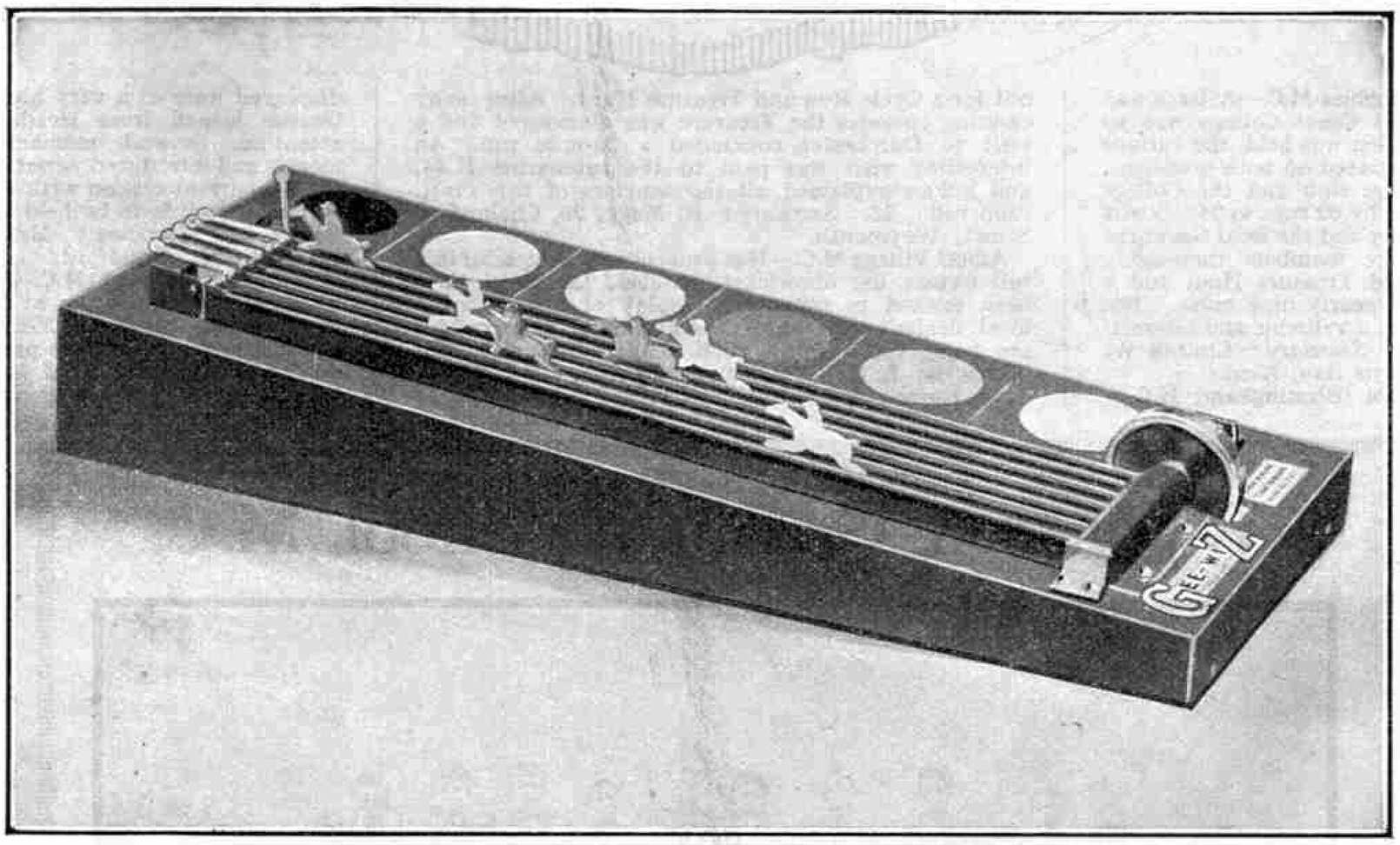
TRADE MARK

CREATING ALL THE BREATHLESS EXCITEMENT OF A REAL HORSE RACE



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Price 7'6 Each

STOCKED BY ALL LEADING STORES AND TOY SHOPS

If difficulty is experienced in obtaining, send 7/6 to the Manufacturers, Paton, Calvert & Co. Ltd., Binns Road, Old Swan, Liverpool, who will have a model despatched to you from the nearest dealer.

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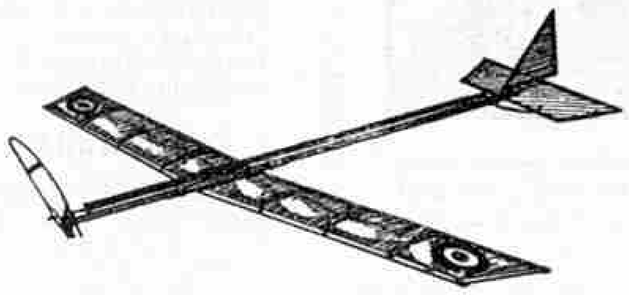

THE 7/6 and 10/6 "TRACTOR" MACHINES are fitted with a combination swivel double bearing and shock-absorbing chassis. This invention gives the propeller a 50% advantage over other Tractor Models regarding breakages.

THE DEMON - 7'6

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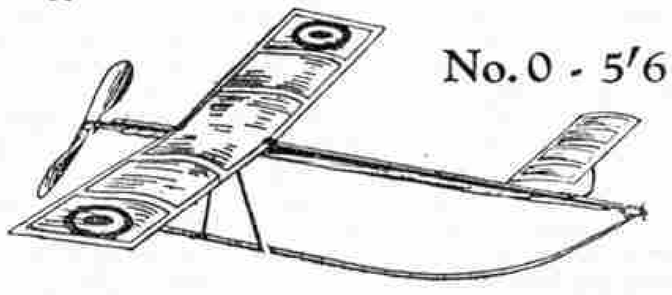

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THE WARNEFORD MODEL AEROPLANE can be obtained from any London Store, or Messrs. Hamley Bros. Ltd., or Branches, and from all the Leading Stores throughout the world.

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HIS MOTTO

"I see you have a sign in your store. 'We aim to Please,'" remarked the irritated customer.

"Certainly," replied the proprietor: "That is our motto."

"Well," retorted the customer, "you ought to take a little time off for target practice."

* * * *

"Those sausages you sent me had meat at one end and bread at the other," said the lady in the butcher's shop.

"Yes, ma'am," replied the butcher, "these hard times it is very difficult to make both ends meat."

* * * *

"If I hit you, young fella, you'll never forget it!"

"Gerrout! If I hit you, you'll never remember it!"

* * * *

During the history lesson the teacher asked the question: "What do you know of Margaret of Anjou?"

"She was very fat, sir," answered one of the boys.

This was new to the teacher, and he asked for the lad's authority.

"It's in the book, sir. 'Among Henry's stoutest supporters was Margaret of Anjou!'"

* * * *

Pat and Mac were out for a walking tour and beginning to feel the pangs of hunger they went into a small inn to eat.

They ordered a large steak pie and sat themselves down at opposite ends of the table. When the pie came, the waiter put it down between them. One half was burnt, and this end was next to Mac. He was not going to be done like this, however, so he said, "Ye ken, Pat, they astronomers are wonderful folk, jist wonderful. They hae sic a control over the universe that they can turn oor world roun', jist like that." And he turned the pie round so that the burnt end was next to Pat.

"Yes I know" said Pat, "but bedad you're no astronomer, so lave the world alone!" And he turned the pie round again!

* * * *

Mother: "What! Baby has swallowed one of your marbles? Go and fetch the doctor, quickly."

Teddy: "Oh, it doesn' matter, Ma. I've got plenty more."

* * * *

A TAC(K)TFUL REASON!

"What makes this yacht jump about so?"

"The boatman says the poor thing's on a tack."

* * * *

Tommy (at his home lessons): "I say dad, can you do this sum for me?"

Father: "I can, but it wouldn't be right."

Tommy: "I don't suppose it would be, but you might have a try!"

* * * *

MAN WITH THE LONG HAIR

A celebrated musician who wears his hair long went into a hairdressing establishment. On taking his seat, he said affably to the assistant: "Ah, I think you're the fellow who cut my hair last time."

"No, sir," replied the other gravely, as he eyed the flowing mop. "It couldn't have been me. I've only been here a couple of years."

COMPOUND INTEREST

Uncle: "Were you pleased with the gun I sent you for your birthday, Jim?"

Jim: "Yes, rather, Uncle, Mother gives me sixpence every week not to use it!"

* * * *

George: "Yes, poor Harry emigrated to America and was killed by a revolving crane."

His Aunt: "My word! What fierce birds they have in America."

* * * *

SAFETY FIRST

Doctor: "About nine patients out of ten don't live through this operation. Is there anything I can do for you before we begin?"

Coloured Patient: "Yessah. Hand me mah hat!"

* * * *

An Aberdonian returning home after several years' absence in Australia was met by his three brothers at the station. The brothers had grown beards during his absence. "What's the bright idea?" he asked.

"Weel, fine ye ken ye took the razor awa' with ye!"

* * * *

Johnny (to neighbour): "Please, Mrs. Jones, have you a pair of scissors you can lend me?"

Mrs. Jones (suspiciously): "Hasn't your mother got a pair you could borrow?"

Johnny: "Oh, yes, but her scissors won't cut tin!"

* * * *

Agent: "This is the motor car you want, sir. You never have to crawl under it to put it right."

Customer: "How's that?"

Agent: "Well, you see, if the slightest thing goes wrong with the mechanism the car instantly turns upside down."

* * * *

"My hair is falling out. Can you recommend something to keep it in?"

"Certainly," replied the chemist's assistant. "Here's a nice cardboard box."

* * * *

Teacher: "Now, Bobby, can you tell me the earliest reference in history to a theatre?"

Bobby: "Yes, Miss, in the Bible."

Teacher: "In the Bible! Are you sure?"

Bobby: "Yes, I remember reading that Joseph was taken from the family circle and put into the pit!"

* * * *

Two Aberdonians were proposing a visit to the pictures one wet afternoon.

"Here's a guid place, noo. It says 2.30 to 10.30 conteenuous."

"It's nae use. It's a quarter tae three."

* * * *

Dealer (rushing into the newspaper office): "See here, you've published an announcement of my death by mistake. That's got to be fixed somehow."

Editor: "Well, we never contradict anything we have published, but I'll tell you what I'll do. I'll put you in the birth's column to-morrow and give you a fresh start."

* * * *

"Three thousand four hundred and ninety-four elephants," said he, "were needed last year to make ivory billiard balls."

"How wonderful," said she, "that beasts of such gigantic proportions can be taught to perform tasks of such a delicate nature!"

DIPLOMACY

A very small boy was trying to lead a St. Bernard up the road, and was having the worst of the "argument."

"Where are you going to take the dog, my little man?" inquired a passer-by.

"I–I'm–going to see where he wants to go first," said the boy.

* * * *

Daisy was possessed of great chattering propensities and almost despairing of a brief spell of quietness, one day her mother promised her a shilling if she did not speak for ten minutes.

There was dead silence for about thirty seconds. Then Daisy broke out: "I'm sorry, mummy, but I can't think of a thing not to talk about!"

* * * *

Molly: "Please, daddy, if I planted this pip, do you think an apple tree would grow up?"

Daddy: "Oh, yes, I think so, my dear!"

Molly: "Well, that's very queer, 'cos it's an orange pip!"

* * * *

CA'CANNY

Donald hadn't come across his friend Sandy since the wedding day, now six months past, and at last they met in Union Street.

"Weel, Sandy," said Donald, "and hoo are ye likin' merried life?"

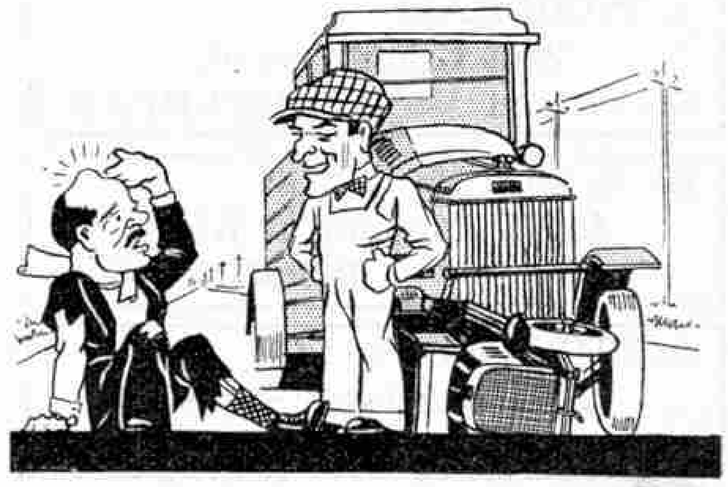
"No' bad," replied Sandy, "but she's aye ask, ask, askin' for money!"

"Hoo much hae ye gi'en her?"

"Nane as yet."

* * * *

THE ONLY POSSIBLE EXCUSE



"Do you mean to tell me you couldn't see me coming on a straight piece of road like this?" asked the owner of the very small car after the collision.

"Sorry, guvnor," said the lorry-driver, "thought it were a fly on my wind-screen."

* * * *

McAndrew: "Hooray, the wind has changed."

Convalescent Wife: "Well, man, what of it?"

McAndrew: "Ye ken the doctor said ye needed a change of air."

* * * *

Rastus: "Yo' ain't got no brains, man."

Mose: "Ain't got no brains? Why, Ah got some brains what ain't nevah been used!"

* * * *

Emigration Agent: "Are you a mechanic?"

Indignant Emigrant: "No, I'm a Macpherson!"

* * * *

A MIRACLE

The Foreman was trying to tell Pat what a miracle was. Pat was working on a skyscraper in New York.

Foreman: "Now, Pat, if you were to climb to the top of this building and fall to the pavement without hurting yourself, what would you call that?"

Pat: "An accident."

Foreman: "And if you did the same thing again, what would you call that?"

Pat: "A coincidence."

Foreman (angrily): "And if you did exactly the same again?"

Pat (triumphantly): "A habit."

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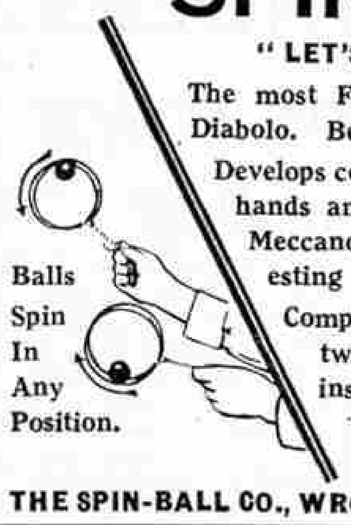

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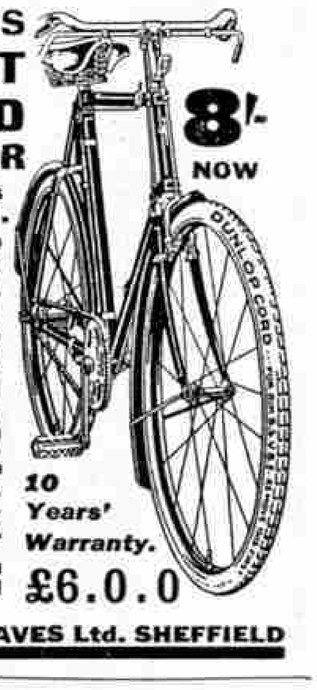

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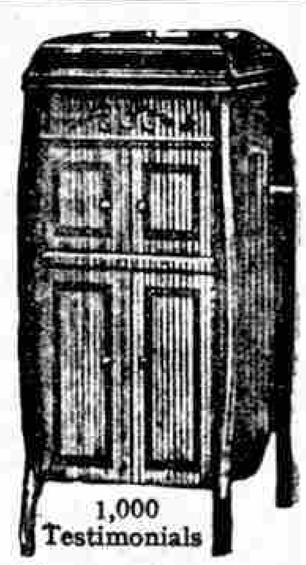

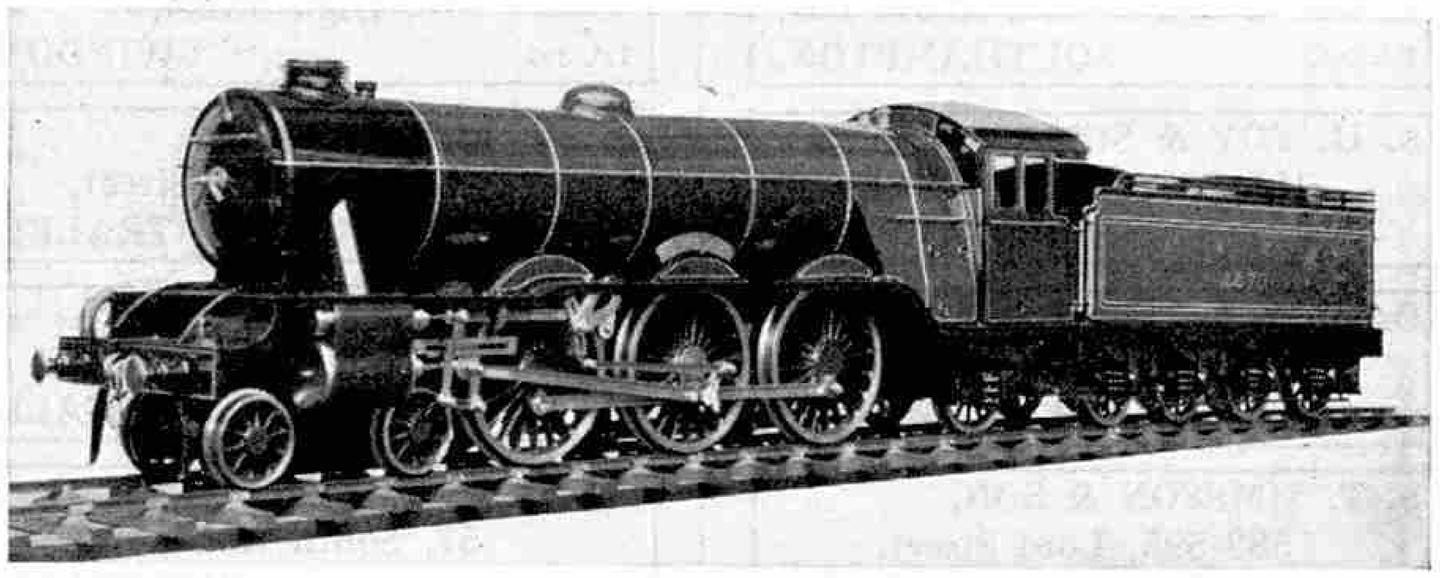

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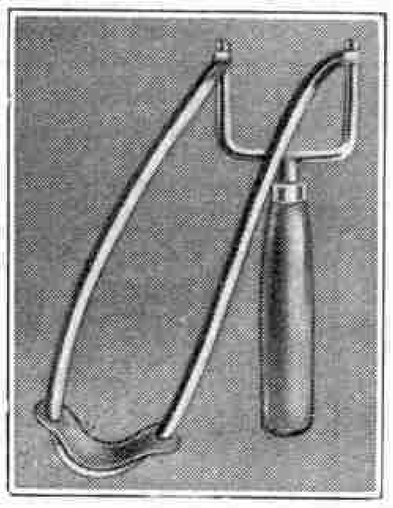

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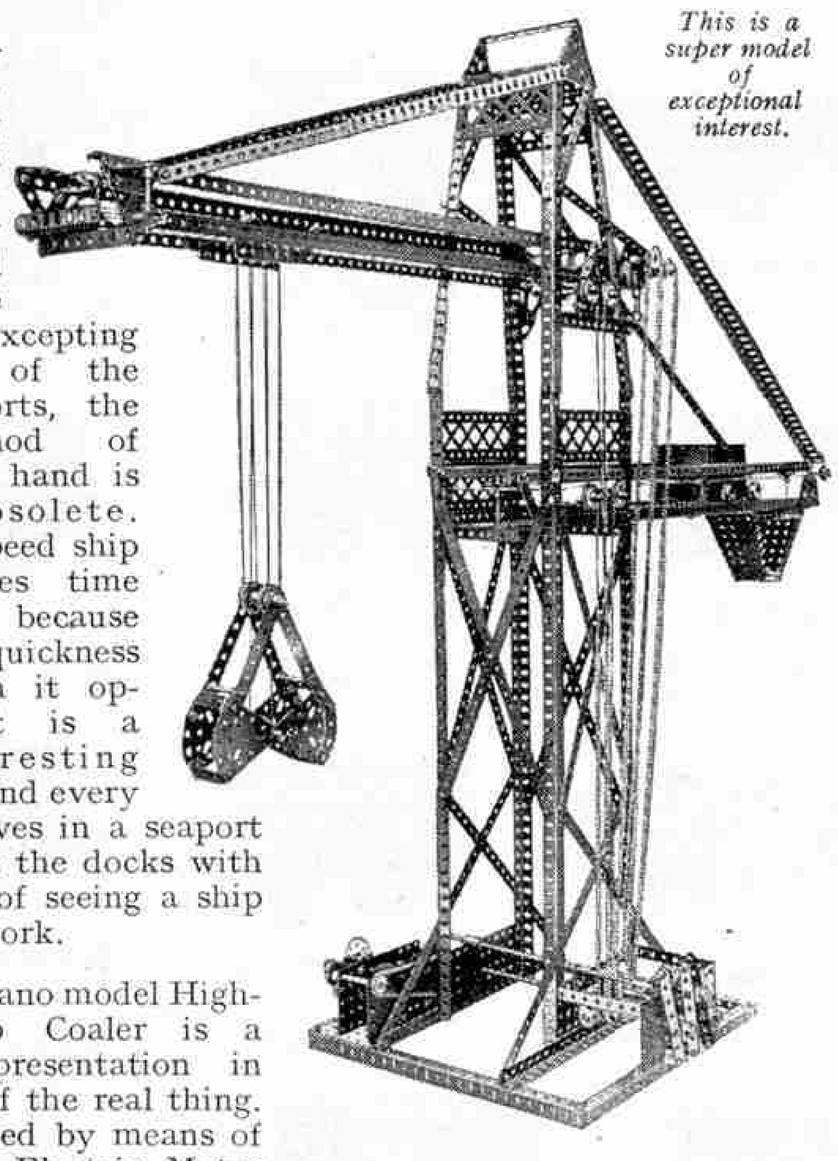
The wonderful possibilities of Meccano are further demonstrated by the splendid models illustrated below—the Meccano High-speed Ship Coaler and the Meccano Motor Cycle and Sidecar.

These models are numbers 2 and 3 respectively in the range of Meccano super models to which we are giving prominence and we hope that every keen Meccano boy will make up his mind to build them. We recommend all boys who live within easy distance of the dealers' stores mentioned to see the models displayed.

No. 2 High-speed Ship Coaler



This is a super model of exceptional interest.

Nearly all coal-burning steamships are mechanically bunkered in these days and, excepting in some of the Eastern ports, the old method of coaling by hand is entirely obsolete. The high-speed ship coaler saves time and money because of the quickness with which it operates. It is a most interesting apparatus and every boy who lives in a seaport should visit the docks with the object of seeing a ship coaler at work.

The Meccano model High-speed Ship Coaler is a correct representation in miniature of the real thing. It is operated by means of a Meccano Electric Motor No. 2 and every movement is duplicated most realistically.

Full instructions for building this model, with illustrations in half-tone, are given in an 8-page folder, which may be obtained from your dealer, price 3d., or direct from Meccano Ltd., Binns Road, Liverpool, price 3d., post free.

The following dealers have purchased models of the High-speed Ship Coaler for demonstration purposes:—

Birmingham. W. E. Hopkins, 73, Rookery Road, Handsworth.
„ W. H. Hull & Son, North Western Arcade.
Bradford, Yorks. Brown Muff & Co. Ltd., Market Street.
Bristol. S. H. Arthur, 15/16, Narrow Wine Street.
„ Lewton, 319, Church Road, St. George.
Chelmsford. Fred. Spalding & Sons Ltd., 4/5, High Street.
Halifax. Nicholl & Brown, 24, Commercial Street.
Leven, Fifeshire. H. Beckers, Shore Head.
Liverpool. H. O'Brien, 457, West Derby Road.
London, N.15. W. G. Ames, 693/697, Seven Sisters Rd., Sth. Tottenham.
„ S.E.2. C. H. Titterton, 89, Dulwich Village.
„ W.1. Hamley Bros. Ltd., Regent Street.
Manchester. Mrs. A. M. Barr, 49, Deansgate.
Sunderland. J. F. Strother, 58/59/60/61, High Street West.
Woodford Green, Essex. A. E. Deeker & Son, 161, High Road.

No. 3 Motor Cycle and Sidecar

This model is an excellent example of Meccano miniature engineering, and offers a remarkable testimonial to the adaptability of the system.

A special instruction folder has been prepared giving full details of the construction of the Motor Cycle and Sidecar. This folder may be obtained from your dealer, price 2d., or direct from Meccano Ltd., Binns Road, Liverpool, price 2d., post free.

The following dealers have purchased models of the Motor Cycle and Sidecar for demonstration purposes:—

Aberdeen. E. A. McMillan Ltd., Union Bridge.
Ashbourne. Chas. Hales, St. John Street.
Bath. Evans & Owen Ltd., Bartlett Street.
Beckenham. W. B. & C. E. Read, 61, Beckenham Road.
Belfast. John F. Crispin, Richmond Library, 313, Antrim Road.
Birmingham. W. E. Hopkins, 73, Rookery Road, Handsworth.
„ W. H. Hull & Son, North Western Arcade.
„ A. E. Oldrey, 700, Washwood Heath Road, Ward End.
Bristol. S. H. Arthur, 15/16, Narrow Wine Street.
Cambridge. Turner & Sons, 47, Regent Street.
Cardiff. Stephens' Toy & Fancy Stores, 24, High Street Arcade.
Chelmsford. Fred. Spalding & Sons Ltd., 4/5, High Street.
Edinburgh. J. M. McIntyre, 130, Easter Road.
Erdington. A. Dudley, 121, Witton Lodge Road, Perry Common,
Fleetwood. H. Mitchell, 169, Lord Street.
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Guildford. G. Watson, Swan Lane.
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„ N.4. H. Peters, 10, Station Road, Finsbury Park.
„ N.6. W. E. Boyce & Son, 329/331/347, Archway Road, Highgate.
„ N.18. E. J. Heraud, 78, Fore Street, Upper Edmonton.
„ S.E.13. C. Cabeldu, 371, High Street, Lewisham.
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„ S.W.1. J. Gash, 48, Regency Street, Westminster.
Lymm. Alfred Kortens, Eagle Brow.
Manchester. J. Marland, 96, Oldham Road, Miles Plating.
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Sunderland. J. F. Strother, 58/59/60/61, High Street West.
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Tyldesley. Robt. Parr & Son, 81, Castle Street.
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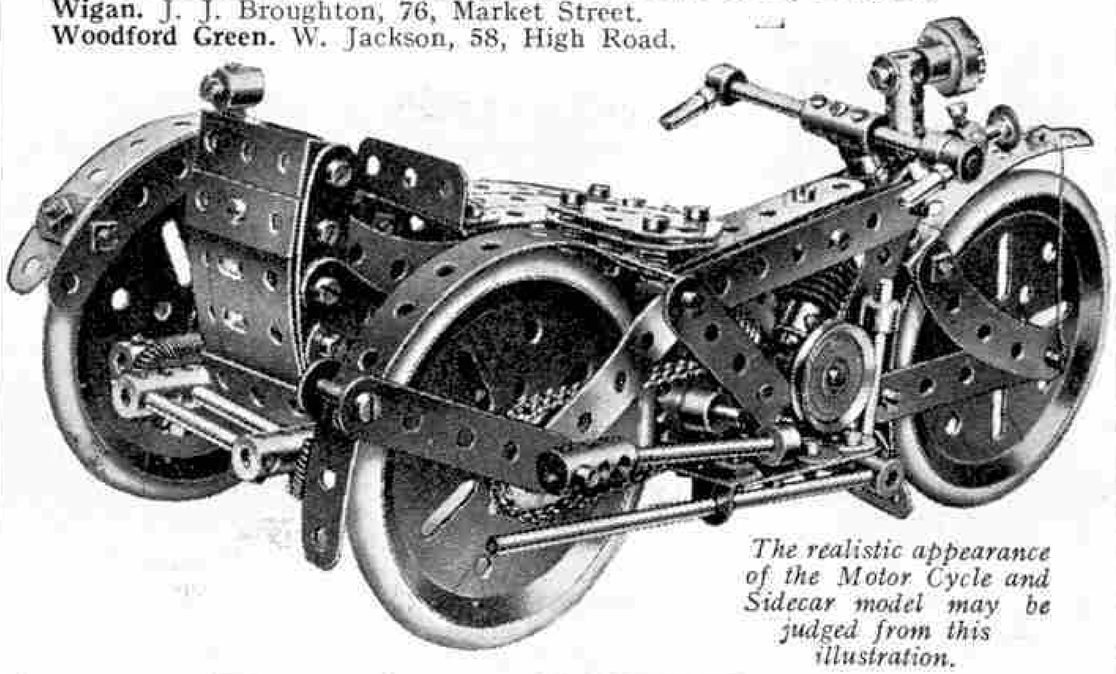
Wigan. J. J. Broughton, 76, Market Street.
Woodford Green. W. Jackson, 58, High Road.



The realistic appearance of the Motor Cycle and Sidecar model may be judged from this illustration.

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Gauge 0 — Hornby Series — Gauge 0

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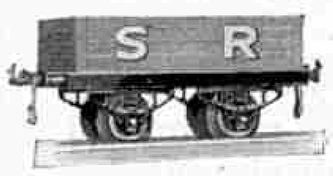
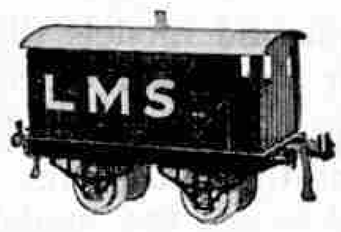
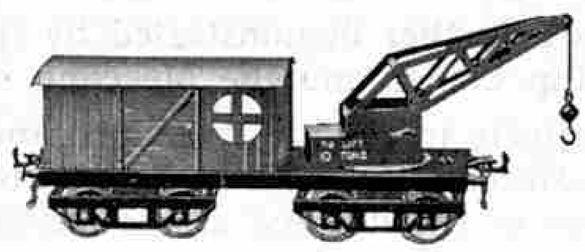
Below we illustrate 35 pieces of Rolling Stock of various types. These form part of the big range of components included in the Hornby Series. All Hornby Rolling Stock is modelled on realistic lines and is beautifully finished in colours. Each piece is available with either L.M.S.R., L.N.E.R., S.R. or G.W.R. lettering. Ask your dealer to show you the full range.



***HORNBY WAGON**
As supplied with Hornby Goods Sets.
Price **2/6**



BRAKE VAN
G.W.R. or L.M.S.R.
Finished in grey, with opening doors. Price **3/6**



***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2-ft. radius rails only. Price **6/3**

BRAKE VAN, L.N.E.R. or S.R.
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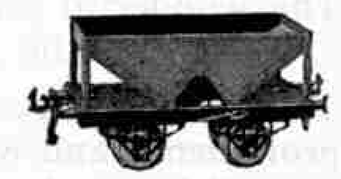
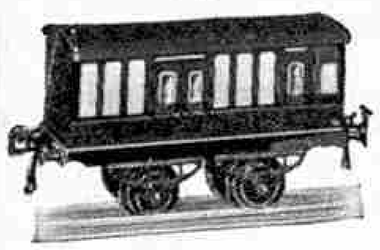


***HOPPER WAGON**
Mechanically unloaded. Finished in green.
Price **4/-**



***GUARD'S VAN**
Realistic design, fitted each side with opening doors. Price **2/6**

WAGON, FRENCH TYPE
Lettered Nord. Highly finished in colours.
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***LUMBER WAGON No. 2**
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only.
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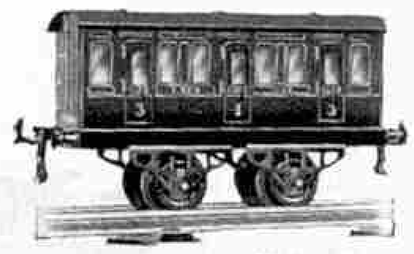
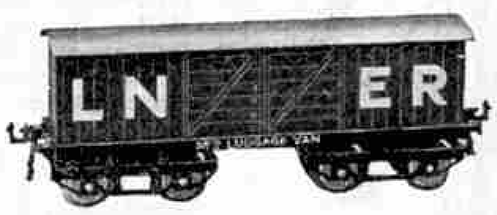
PETROL TANK WAGON "B.P."
Finished in Cream.
Price **2/6**



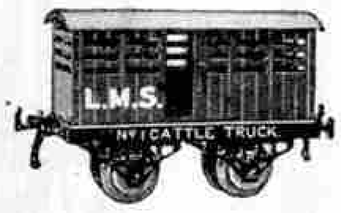
***HORNBY PASSENGER COACH No. 0-1**
As supplied with Hornby No. 0 and No. 1 Passenger Sets ... Price **2/6**

PETROL TANK WAGON "PRATTS"
Finished in green. Price **2/6**

***MILK TRAFFIC VAN**
Fitted with sliding door, complete with milk cans.
Price **3/6**



***LUGGAGE VAN No. 2**
Finished in two shades of blue. Fitted with double doors. Suitable for 2-ft. radius rails only. Price **5/9**



***CATTLE TRUCK No. 1**
Fitted with sliding door. Very realistic design.
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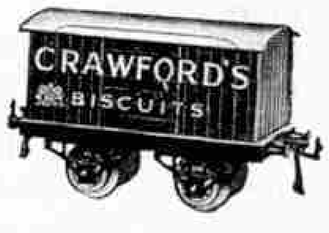
PETROL TANK WAGON "SHELL"
Finished in red. Price **2/6**

JACOB'S BISCUIT VAN
Finished in crimson lake, with opening doors.
Price **3/6**

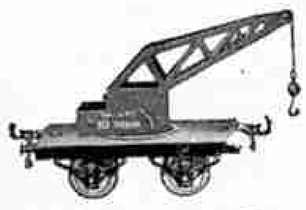
CARR'S BISCUIT VAN
Finished in blue, with opening doors.
Price **3/6**

***TIMBER WAGON No. 2**
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **3/6**

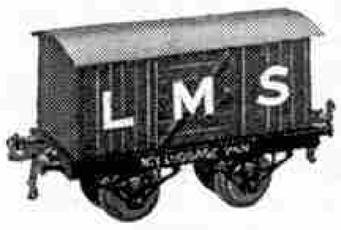
SECCOTINE VAN
Beautifully finished in blue, with opening doors.
Price **3/6**



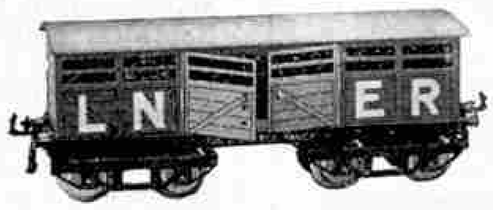
CRAWFORD'S BISCUIT VAN
Finished in red, with opening doors. Price **3/6**



***CRANE TRUCK**
Finished in brown and blue. Price **3/6**

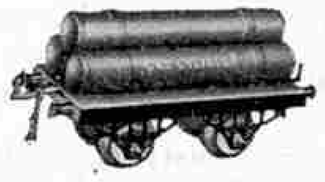


***No. 1 LUGGAGE VAN**
With opening doors.
Price **3/6**

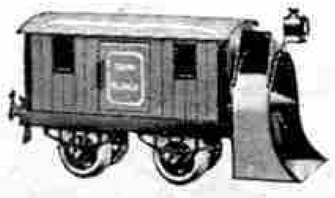


***CATTLE TRUCK No. 2**
Splendid model fitted with double doors. Suitable for 2-ft. radius rails only. Price **5/9**

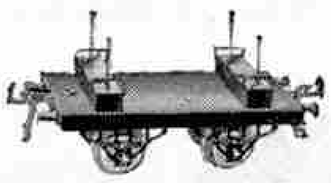
***GUNPOWDER VAN**
Finished in red, with opening doors. Price **3/9**



***GAS CYLINDER WAGON**
Finished in red, lettered gold. Price **2/6**



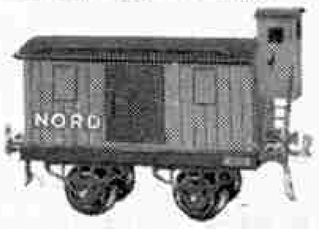
***SNOW PLOUGH**
With revolving plough driven from front axle.
Price **5/6**



***LUMBER WAGON No. 1**
Fitted with bolsters and stanchions for log transport.
Price **2/-**

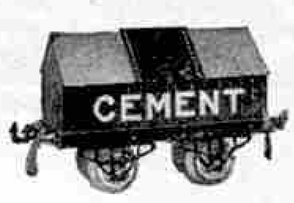
***TROLLEY WAGON**
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **5/6**

***TIMBER WAGON No. 1**
Beautifully enamelled in green and red. Price **1/9**

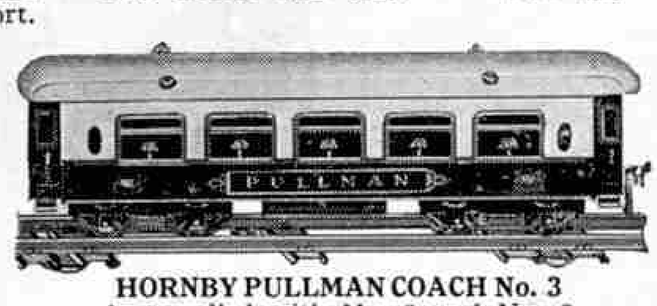


BRAKE VAN, FRENCH TYPE
Lettered Nord. Beautifully finished in colours. Opening doors. Price **4/-**

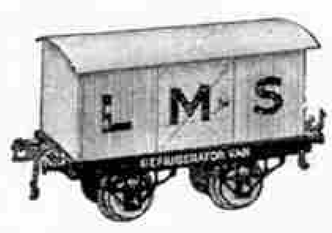
SIDE TIPPING WAGON
Excellent design and finish.
Price **2/6**



***CEMENT WAGON**
Finished in red.
Price **3/-**



HORNBY PULLMAN COACH No. 3
As supplied with No. 2 and No. 3 Train Sets. Suitable for 2ft. radius rails only ... Price **11/6**



***REFRIGERATOR VAN**
Beautifully enamelled with opening doors.
Price **3/9**

ROTARY TIPPING WAGON
Finished in orange.
Price **3/-**

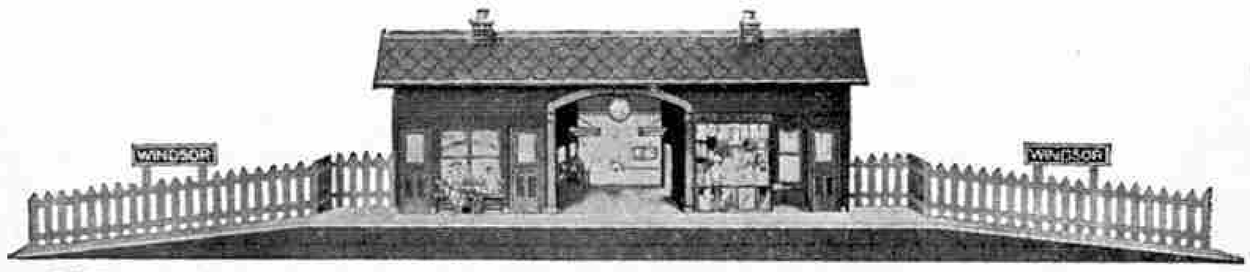
Lettered L.M.S., N.E., S.R. or G.W.

Manufactured by MECCANO LIMITED, BINNS ROAD, LIVERPOOL

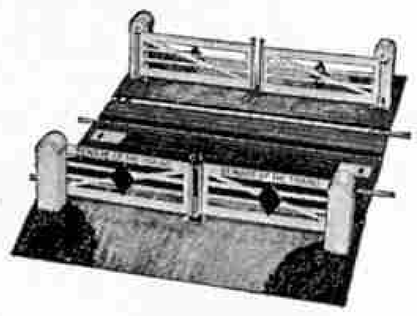
STATIONS AND ACCESSORIES

Hornby Series

The Hornby System consists of a comprehensive range of Stations, Platforms and Accessories with which the most elaborate model Railway Terminus or Goods Yard may be constructed. Every item is exceptionally well designed and is carefully modelled on its prototype in real life. A selection of the various components included in the Hornby Series of Stations and Accessories is illustrated below.



RAILWAY STATION No. 2. Excellent model, well designed and finished. Constructed in three sections which are detachable. Dimensions: Length 2-ft. 9-in., breadth 6-in., height 7-in. ... ... Price **10/–**

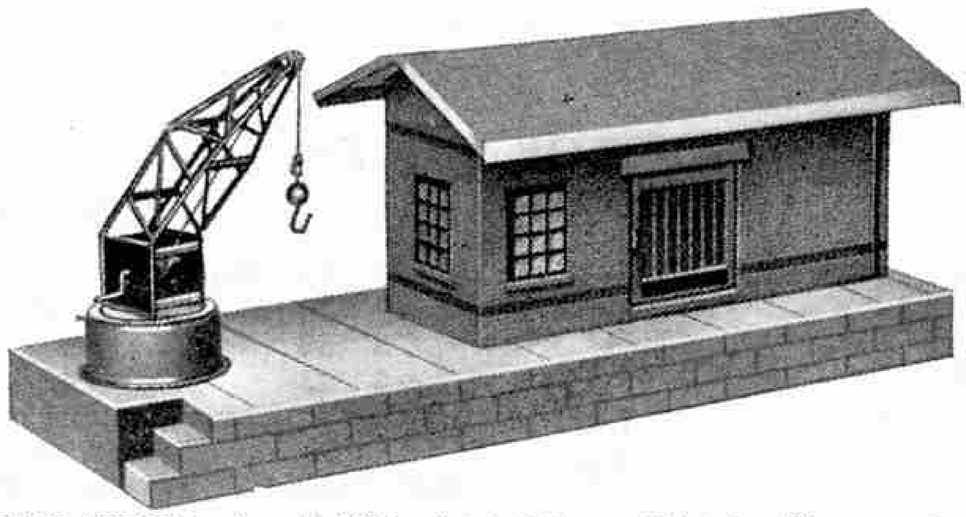


LEVEL CROSSING No. 2
Beautifully designed in colours. Measures 11½ × 7½-in. with Gauge 0 rails in position.
Price **5/–**

SIGNAL CABIN No. 2
Dimensions: Height 6½-in., Width 3½-in., Length 6½-in. Finished in colours and lettered "Windsor." Roof and back open to allow a signal lever frame to be fitted inside cabin, if desired, and operated. Price **6/6**

PASSENGER PLATFORM. Length 16¾-in., width 3-in. This platform may be connected to the main station or used separately. The interlocking device at each end enables a number of these platforms to be joined together ... ... Price **3/6**

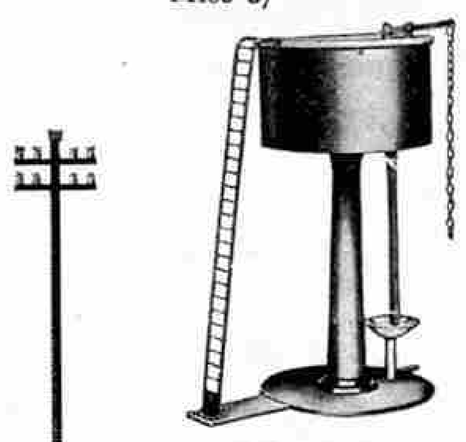
White paled fencing as supplied with the Passenger Platform may also be purchased separately ... ... Price per length **6d.**



GOODS PLATFORM. Length 16¾-in., height 6¾-in., width 6-in. The crane is enamelled in bright red and is fitted with a crank and ratchet mechanism for controlling the load. Price **10/6**

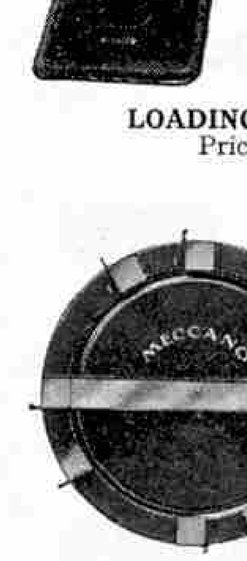
ISLAND PLATFORM. Length 32¼-in., height 6¾-in., width 3-in. The ramps at either end are detachable. Attractively coloured in green, blue and white ... ... Price **7/6**

Ramps similar to those fitted to the Island Platform may be purchased separately. Price **9d.** each.



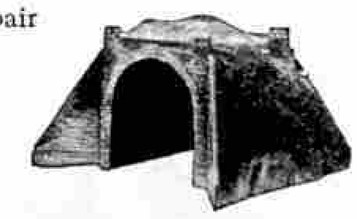
WATER TANK
Brightly coloured. Stands 8½-in. high. Fitted with flexible tube and valve lever.
Price **6/6**

TELEGRAPH POLES
Price per pair **3/6**



LOADING GAUGE
Price **1/9**

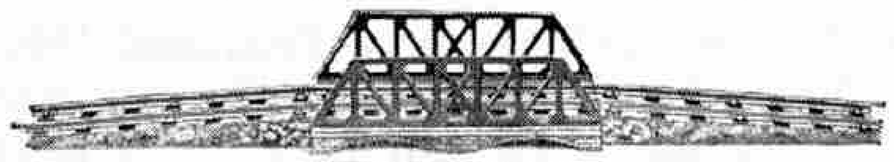
LAMP STANDARD No. 1 (SINGLE)
A 4-volt bulb may be fitted into the globe. Price **3/–**



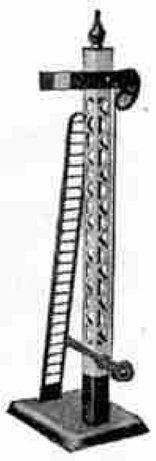
TUNNEL
Realistic and finished in colours ... Price **7/6**

RAILWAY STATION No. 1. A well-made model, richly finished in colours. By placing one or more of these Stations at intervals along the track, and using the Railway Station No. 2 as the main terminus, a very realistic effect is given to a miniature lay-out. Dimensions: Length 16¾-in., width 6-in., height 9-in. .. .. Price **5/–**

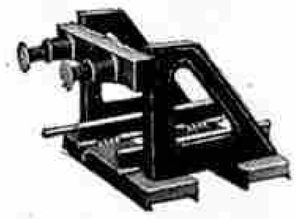
TURN-TABLE No. 1 2/6
TURN-TABLE No. 2
(As Illustrated) **4/–**



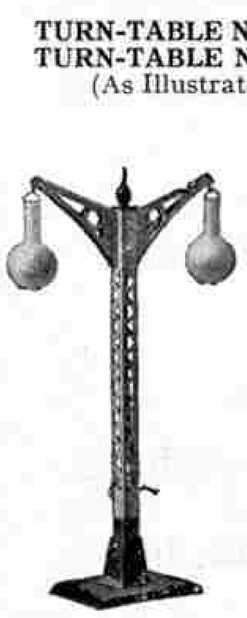
VIADUCT. Price **7/–**
ELECTRICAL VIADUCT. Price **8/–**
Centre Section for Viaduct. Price **4/6**
Centre Section for Electrical Viaduct. Price **5/–**



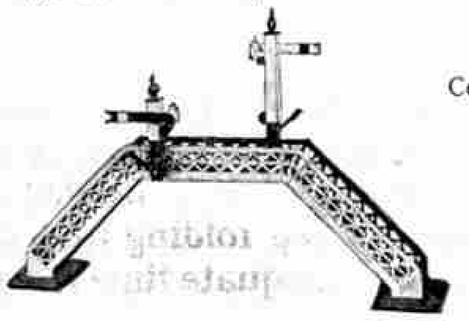
SIGNAL No. 2
"Home" or "Distant"
Price **2/6**



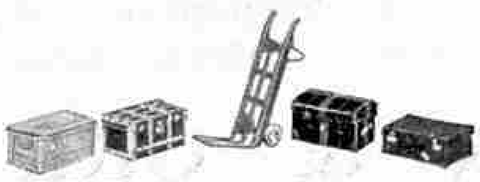
BUFFER STOPS No. 1 (SPRING)
Price **1/–**



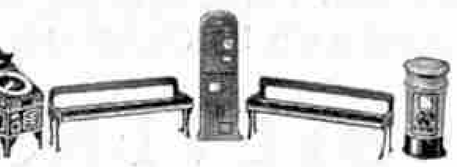
LAMP STANDARD No. 2 (DOUBLE)
Four-volt bulbs may be fitted into the globes.
Price **4/–**



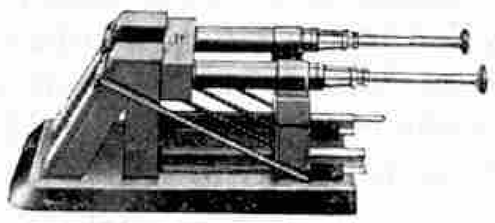
FOOTBRIDGE
No. 1. Without Signals ... Price **3/6**
No. 2. With detachable Signals ,, **6/–**
Signals only ... ... per pair **2/9**



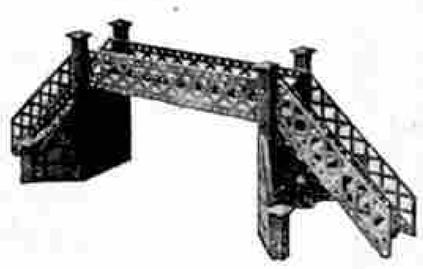
RAILWAY ACCESSORIES
No. 1. Miniature Luggage and Truck.
Price per set **1/6**



RAILWAY ACCESSORIES
No. 3. Platform Machines, etc. Price per set **1/6**

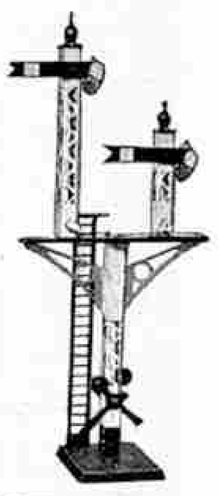


BUFFER STOPS No. 2 (HYDRAULIC) Price **5/–**



LATTICE GIRDER BRIDGE
Constructional type. Strong and well proportioned.
Price **9/6**

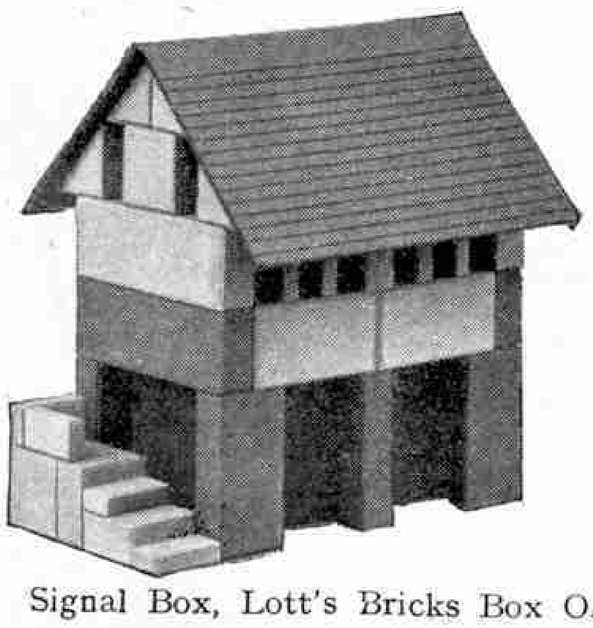
RAILWAY ACCESSORIES
No. 2. Milk Cans and Truck.
Price per set **1/6**



JUNCTION SIGNAL
"Home" or "Distant." Signal arms operated by levers at base. Very realistic model standing 14-in. in height.
Price **5/6**

LOTT'S BRICKS

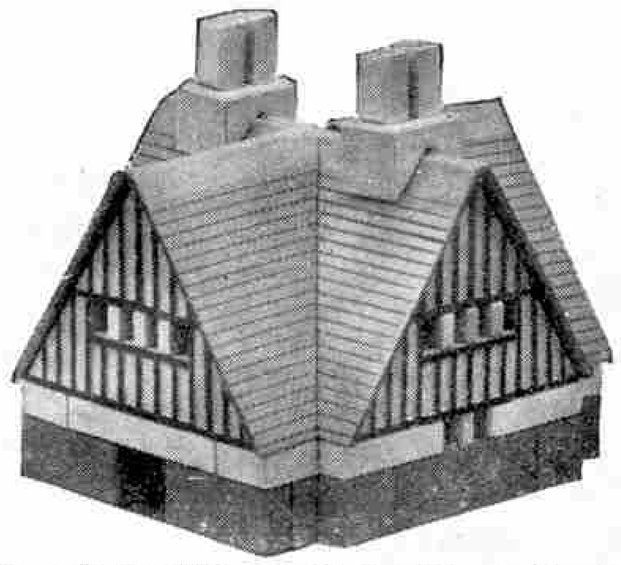
SOLID STONE BUILDING BRICKS



Signal Box, Lott's Bricks Box OA

Every boy can build Houses, Bridges, Railway Stations, Signal Boxes, Farm Buildings, etc., with a box of Lott's Bricks or Tudor Blocks. Buildings made with these bricks are ideal for use in every kind of model display. The cost too is moderate when compared with that of other methods of model building, and like real structures they are built in solid stone. Ask your dealer for particulars, to-day, or write for illustrated list to Lott's Bricks Ltd., Watford.

The Sets are complete with Bricks, Roofs, and Plans for the number of Models stated below.



Four Gabled House, Tudor Blocks Box 2

LIST OF PRICES

LOTT'S BRICKS

Box 0	6	Models	2/–	Box 0a	12	Models	3/3
„ 1	30	„	5/–	„ 1a	12	„	5/6
„ 2	48	„	10/–	„ 2a	18	„	10/6
„ 3	72	„	17/6	„ 3a	6	„	7/6
„ 4	84	„	30/–	„ 4a	6	„	7/6

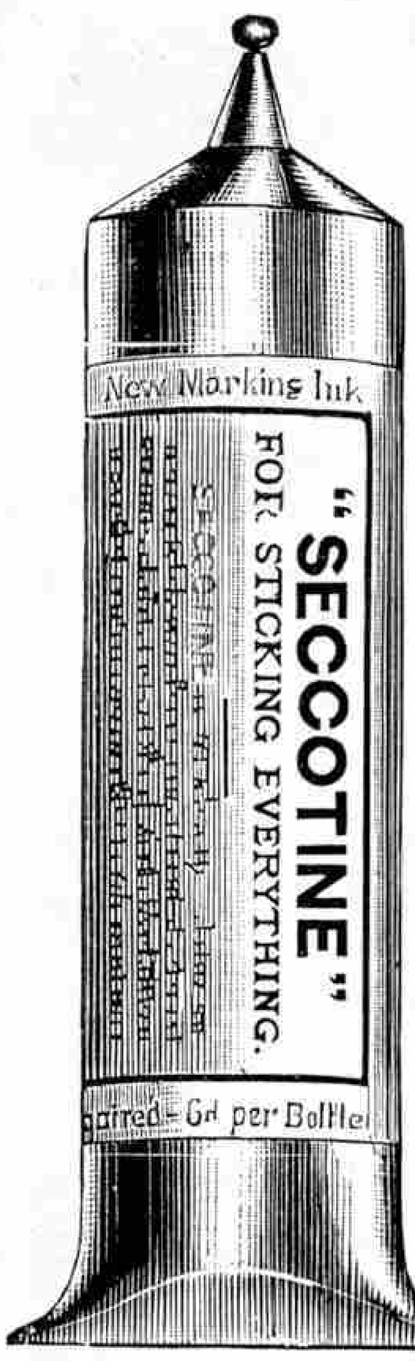
Box 5 100 Models 42/–

TUDOR BLOCKS

Box 1	12	Models	3/6	Box 1a	Supplement		4/6
„ 2	18	„	7/6	„ 2a	„		10/6
„ 3	36	„	21/–	„ 3a	„		25/–
„ 4	43	„	42/–				

GARDEN SETS. Containing trees, fences, extra roofs, etc. ... ... 4/– and 6/–

KINDERGARTEN. Sets of assorted colour blocks, 18 designs ... ... 2/– and 5/–



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THE TUBE OF

SECCOTINE

The World's Great Adhesive. Registered Trade Mark.

WITH it he can mend a thousand things—his bats, balls, boats, boxes, bags, books, &c. He can make numberless things that a boy likes. He can help his mother by mending breakages in house furniture, anything—everything.

NOTE. There is nothing messy about Seccotine. Use the spike or pin supplied to open a new tube—at top of cone—press gently at end of tube (at folded part) for as much adhesive as is needed—then replace spike or pin which acts as stopper. Keep folding tube end as contents are withdrawn. Give mended article adequate time for drying.

TUBES are 4½d. (vest pocket box), 6d. and 9d. each. Sold everywhere.

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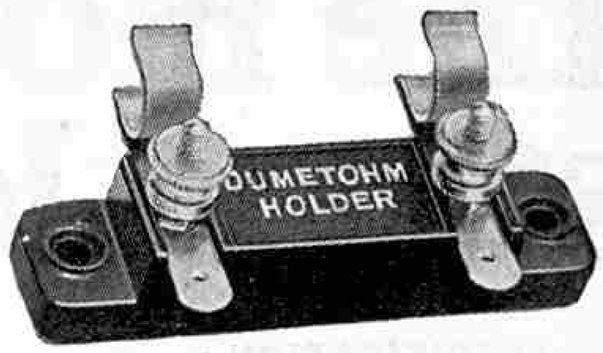

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Horizontal or Vertical
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Upright or Flat
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Dubilier Mansbridge Condensers,
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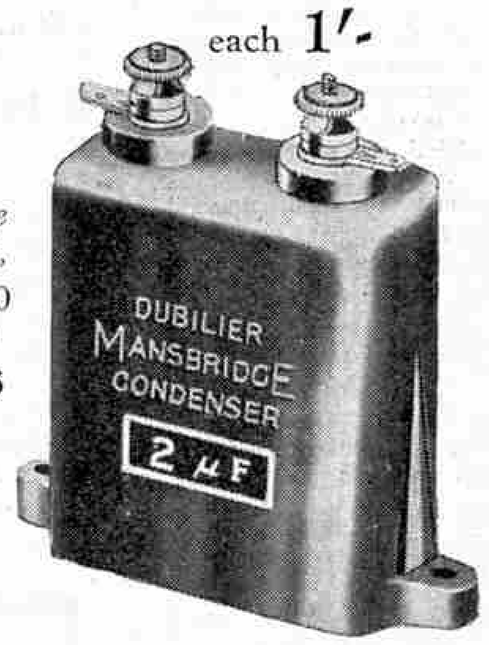

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Ideal for Electric Bells.

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There are suitable Exide batteries for every wireless H.T. and L.T. need.

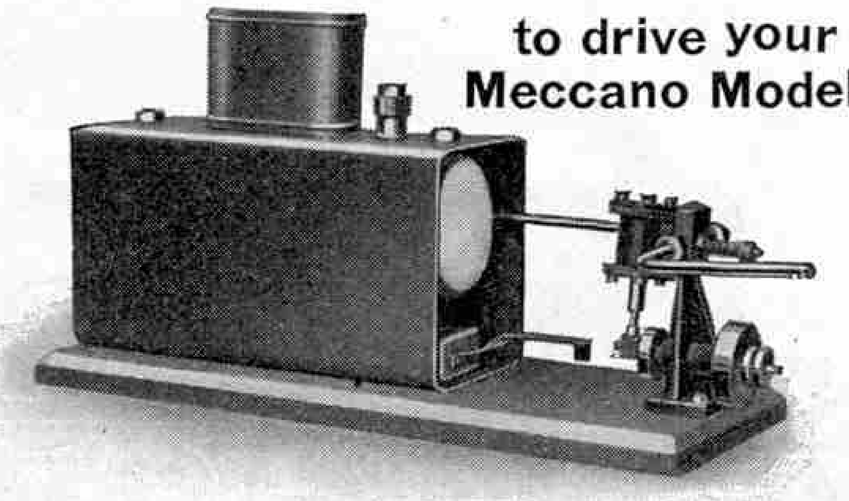
Use an Exide Battery on your car.

For operating Meccano electrical models, **Exide patent unspillable cells** are specially recommended. Write for Folder 5,000/M.

Obtainable from any Exide Service Station or your local dealer.

Advt. of The Chloride Electrical Storage Co. Ltd., Clifton Junction, nr. Manchester.

You must have the S.T. ENGINE to drive your Meccano Models



S.T. Engine Parts ... 5/– Finished Boiler ... 8/–
Finished Plant on Base, as illustrated ... 17/6
Post Free.

It is utterly different from the ordinary Toy Shop model engine, you have the pleasure of building it yourself.

We **guarantee** it will work when you have built it.

Like all Stuart models it is made on correct engineering lines and therefore has **Power.**

The Boiler is of Copper, brazed throughout and tested.

From a letter dated 10th June, 1928.

"I want a new lamp for the S.T. Plant I bought 3 years ago. It is still giving fine service, hauling heavy crane loads, etc., and looks as good as new."

Send a stamp for list 12M which describes this and several other simple models, or better still a Postal Order for 6d. for our new 96 page

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fully illustrated and packed with interest from cover to cover.

Stuart Turner Ltd., Henley-on-Thames

The most wonderful model steam loco ever made!

SPECIFICATION :

Bowman Express Loco Model 234. Solid brass and steel throughout and fully guaranteed.

BOILER. — Heavy seamless brass tested to 3 times working pressure. New Bowman safety valve. Overflow plug for filling to correct level.

CYLINDERS. — Drawn brass ⅜" × ⅜". Solid brass pistons with grooved oil-rings. Special felt oiling pads.

FRAME.—Heavy steel plate.

WHEELS.—Turned steel.

LAMP.—Safety type, asbestos wicks. Goes out if overturned.

GAUGE "0."—For 2' radius.

PACKING.—Complete in strong box with tube of oil, filling funnel and full instructions.

NOTE THE MASSIVE PROPORTIONS:

Length of Engine and Tender, 1 ft. 8 ins.

PRICE OF LOCO:

27/6

TENDER: **7/6** extra

Post U.K. 1/-, abroad 4/-

183 MILES! This is the wonder Bowman Loco which pulled 6 large coaches (as illustrated) for a distance of 183 miles during the B.I.F. It was re-fuelled every 40 minutes, a journey of 1½ miles. A £5 foreign steam engine refused to pull half the load and ran for 12 minutes only, on one filling.

A NEW CRAZE. Think of the joy such an engine can add to your railway system! It runs up your own "O" gauge track and pulls your rolling stock 1½ miles amidst clouds of steam from the chimney and the true exhaust steam sound of a real locomotive. Owing to its unusual power, an outdoor steam railway is now possible. Here real journeys can be accomplished, and you can build cuttings, embankments, tunnels and bridges in a most realistic manner.

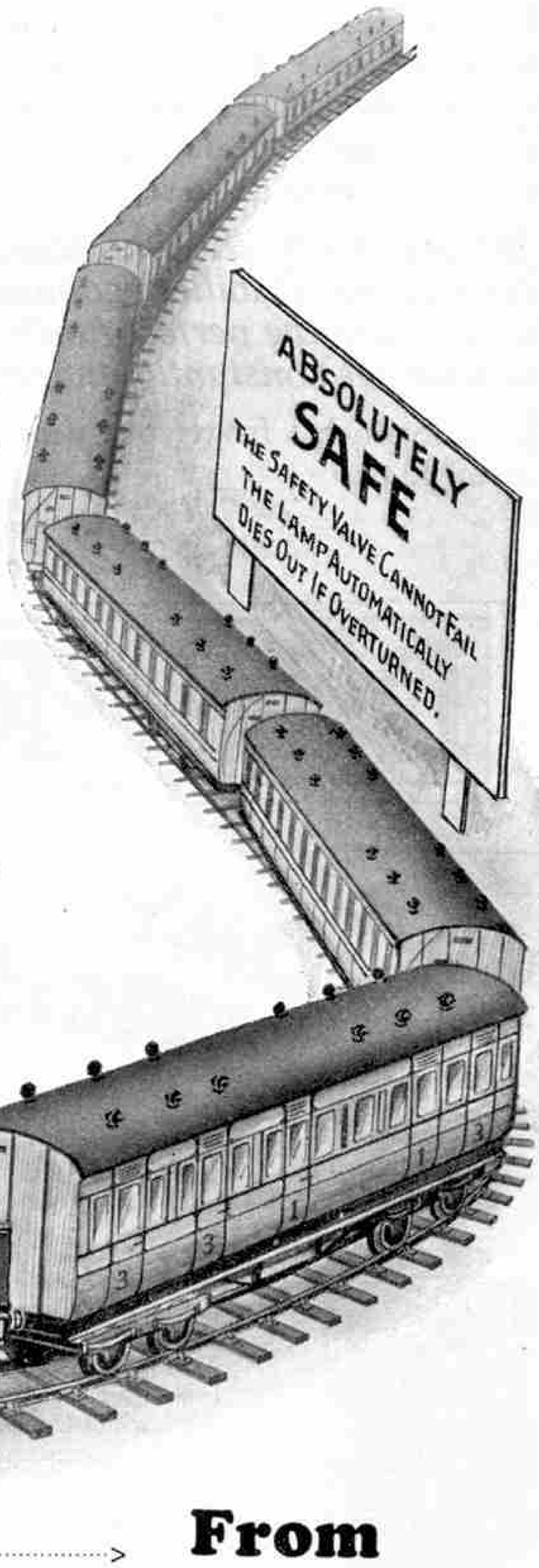
2/- DEPOSIT SECURES YOUR LOCO FOR XMAS. The demand for this loco is so great that we may be sold out by December. Make sure of yours *now*—your dealer will reserve it for you for 2/- deposit. If he does not stock Bowman Models, send his name and P.O. 2/-, when we will reserve it for you.

Send 3d. for the Bowman

WONDER BOOK of WORKING MODELS

A fascinating list of steam engines from 6/6 and full details of this loco, illustrated full size and in colours. Notes on running, etc.

Ask your dealer to show you this Bowman Loco MODEL 234.



< ..... 1 foot 8 inches ..... >

SAME SIZE AS USUAL £6 : 0 : 0 MODELS

From Oct. 8th to 13th you can see this Loco running under steam — at your shop

The following firms are demonstrating from Oct. 8th to 13th :—

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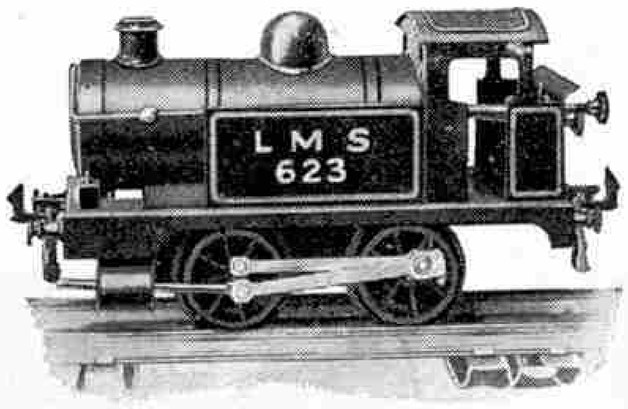
HORNBY TANK LOCOS



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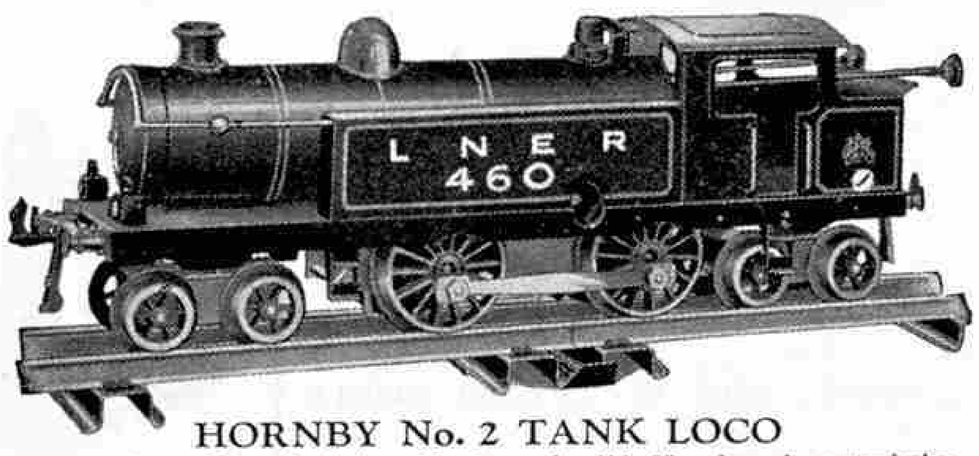

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Powerful model embodying all the splendid Hornby characteristics. It is 10½″ in length and is fitted at both ends with a four-wheeled bogey. Beautifully finished in colours to represent L.M.S., L.N.E. or G.W. Railway Companies' Locos, and suitably lettered. Fitted with reversing gear, brake and governor. Suitable for 2-ft. radius rails only. Price **22/6**

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JAEGER
Pure Wool

The 1928 Jaeger Meccano Jerseys

Boys who love Meccano delight in these charming knitted garments. They are smart little outfits which can be had in a variety of colours. The neat dice effect being in a variety of colours.

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7/– for 22 in. chest, rising 9d. per 2 in. size to 30 in.

Knitted Suit No. 852

13/– for 20 in. chest, rising 1/– per 2 in. size to 26 in.

¾ Hose, Turnover Tops to match from 2/9 for size 3 to 3/9 for size 10.

Colours :

Navy with Royal Blue and Saxe border.
Drab with Brown and Saxe border.
Mixed Grey with Red and Saxe border.
Fawn with Navy and Saxe border.
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Saxe with Navy and Light Saxe border.

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9 models supplied on heavy wood base or on painted metal base drilled with Meccano pattern equidistant holes by permission.

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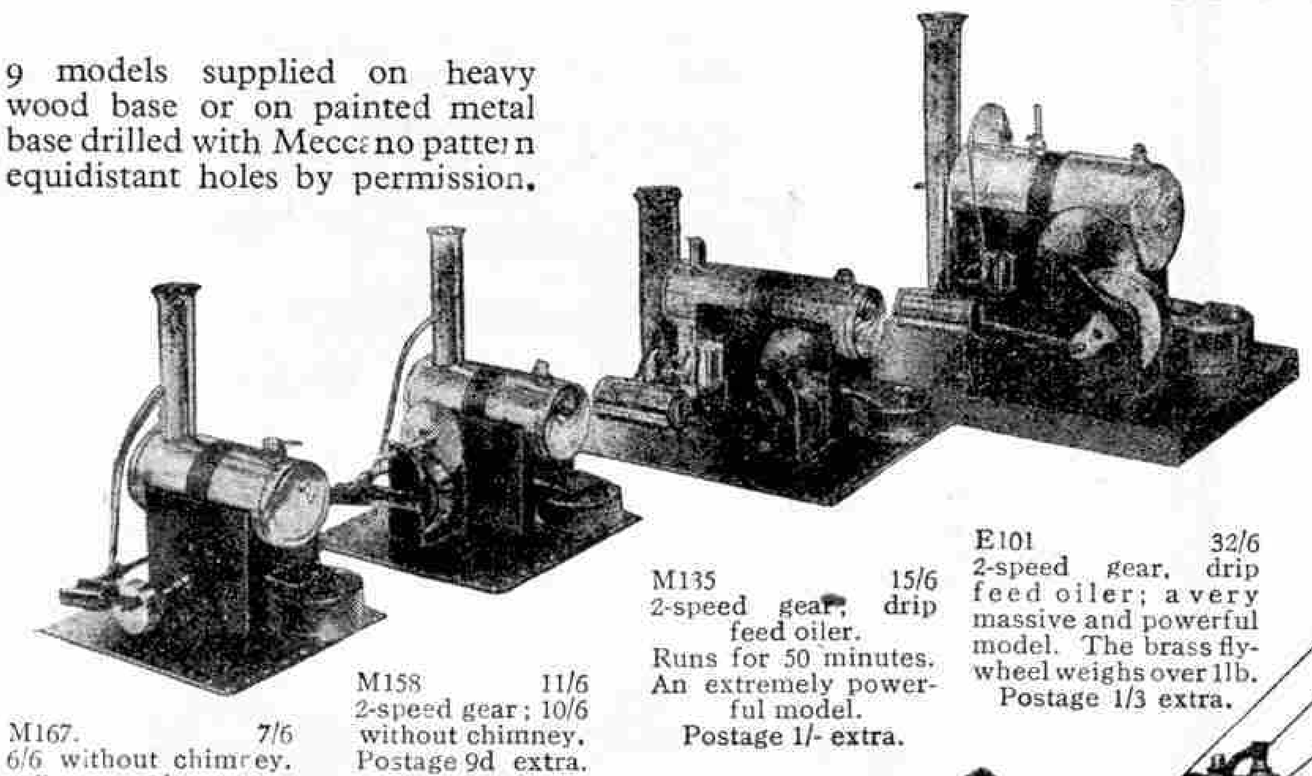

M167. 7/6
6/6 without chimney.
Postage 6d. extra.

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2-speed gear; 10/6 without chimney.
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M135 15/6
2-speed gear; drip feed oiler.
Runs for 50 minutes.
An extremely powerful model.
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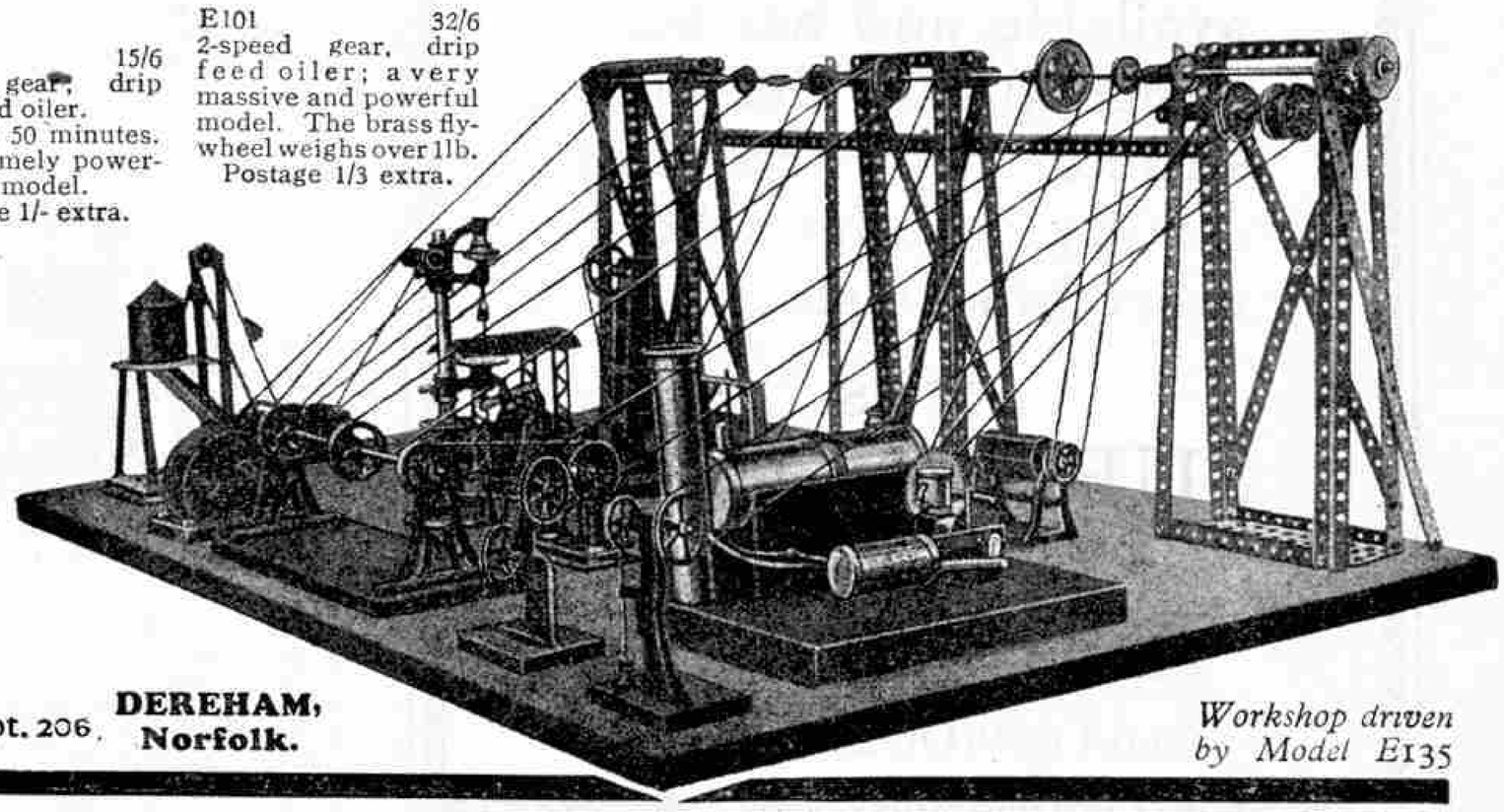
E101 32/6
2-speed gear, drip feed oiler; a very massive and powerful model. The brass flywheel weighs over 1lb.
Postage 1/3 extra.



Workshop driven by Model E135

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Send 3d. for the Bowman
WONDER BOOK OF WORKING MODELS.
Fascinating details of steam engines; full-size and coloured illustrations of the new Loco. Interesting notes on running, etc.

BOWMAN MODELS, Dept. 206, **DEREHAM, Norfolk.**

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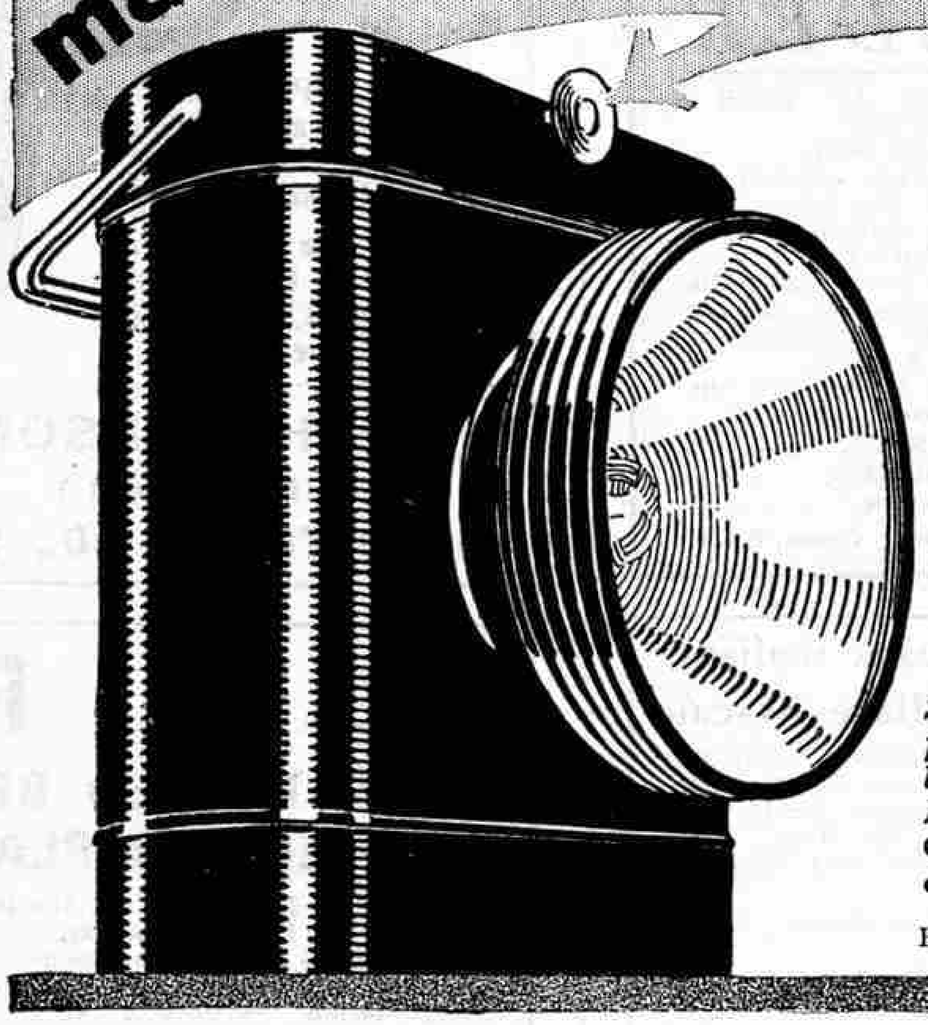

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3/6

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An exciting episode in the October number

SERIALS

" The Vultures of Desolate Island," by G. E. ROCHESTER. The further adventures of Harry Davies, the Flying Beetle.
" Under Ringwood's Rule," by MICHAEL POOLE. An exciting story of school life and adventure.
" The Liberators," by CAPT. K. MACLURE. Here we meet again Colin Carstairs and his friends, the big negro Carby, and Peter Dugget, the Cockney.
" Wrackness Island," by G. PROUT. A story of the doings of a group of Sea and Land Scouts in and about the rivers of the East Coast and on a mysterious island.

COMPLETE STORIES

" The Doom of San Juan," a thrilling account of the destruction of a nest of pirates.
" Jack Langley's Last Fight," how a highwayman was brought to book.
" The Fairy Godmother," our old friend Blundell in a new rôle.
" Captives of the Khalifa," a grim story, founded on fact.
" The Test that Failed," a laughable yarn of camp life, etc., etc.

ARTICLES

The " Behind the Scenes " series will be continued, and " Adsum " has in hand a number of wireless articles. As usual, there will be many " how-to-make " pages, articles on Sport, on Scouting, O.T.C. work, etc., and on subjects of general interest. There will again be pages for the philatelist, the collector, the chess-player.

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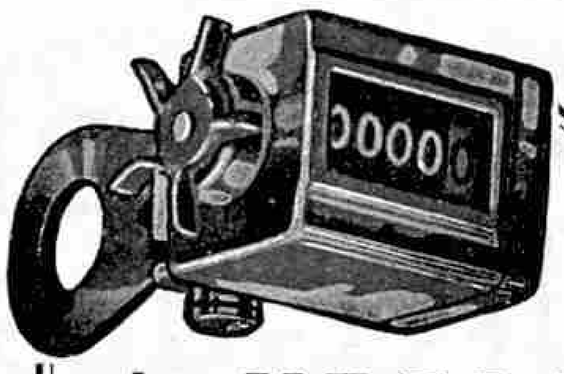

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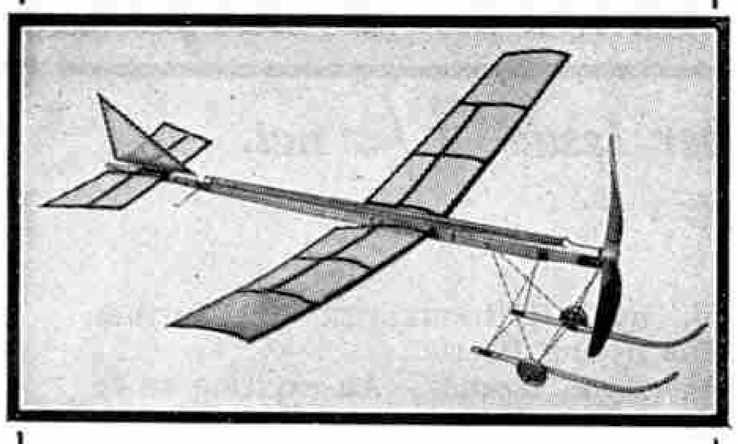

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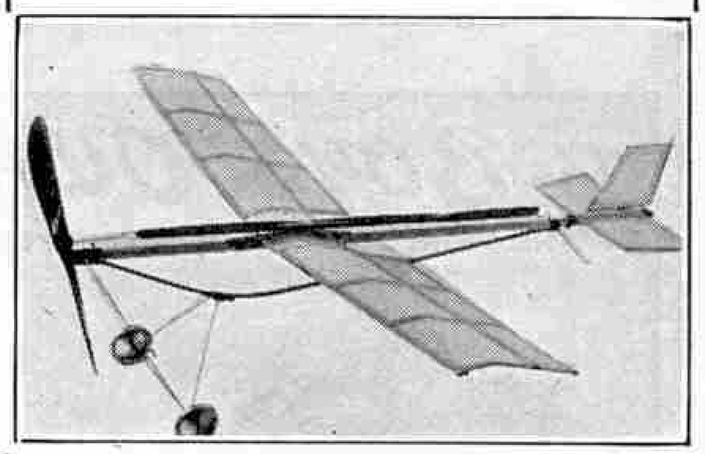

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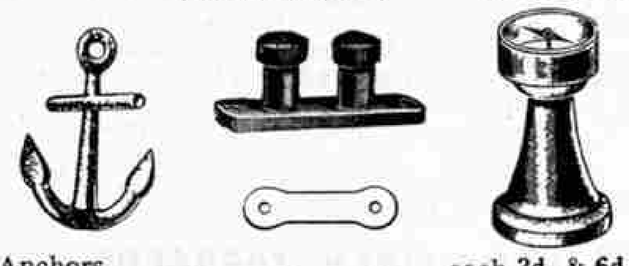

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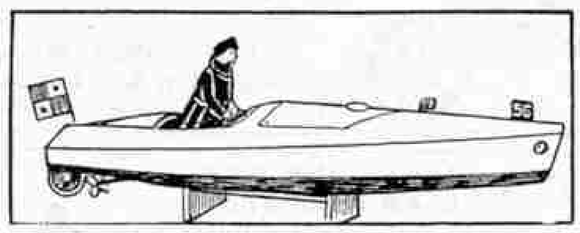

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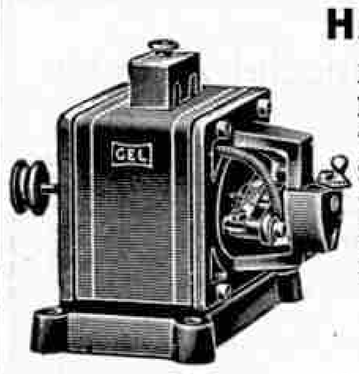

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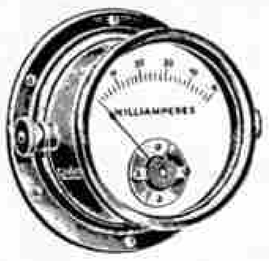

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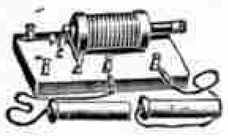

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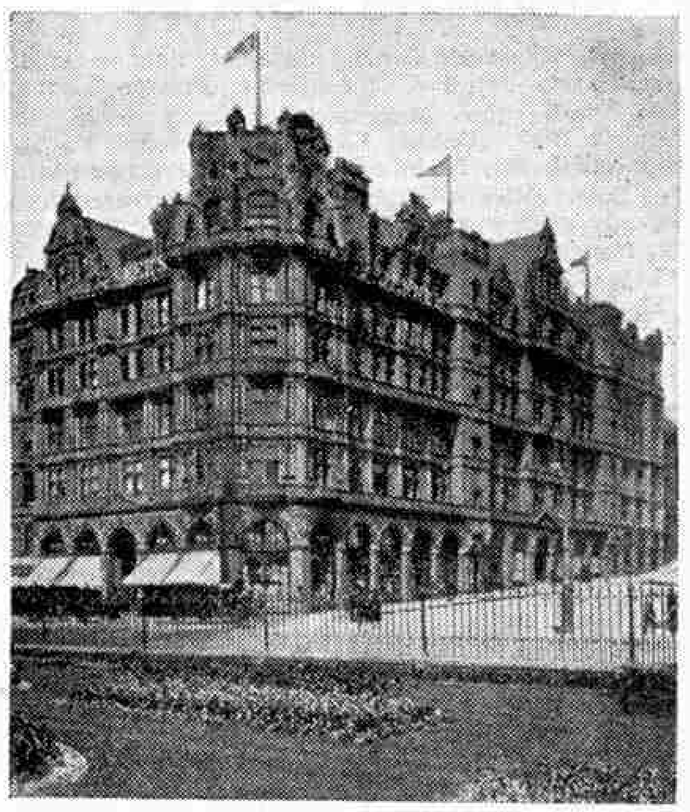

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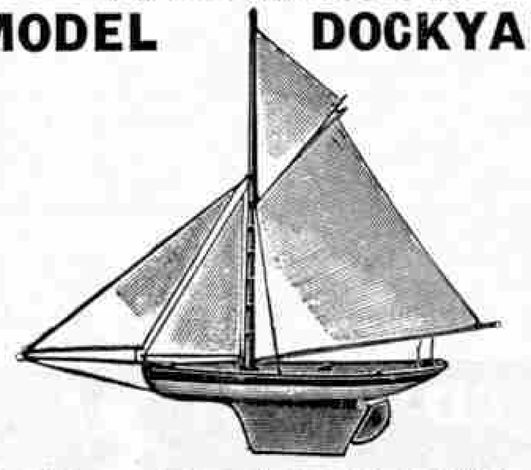

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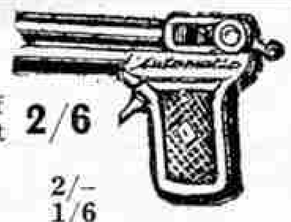

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Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/- for six issues and 8/- for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

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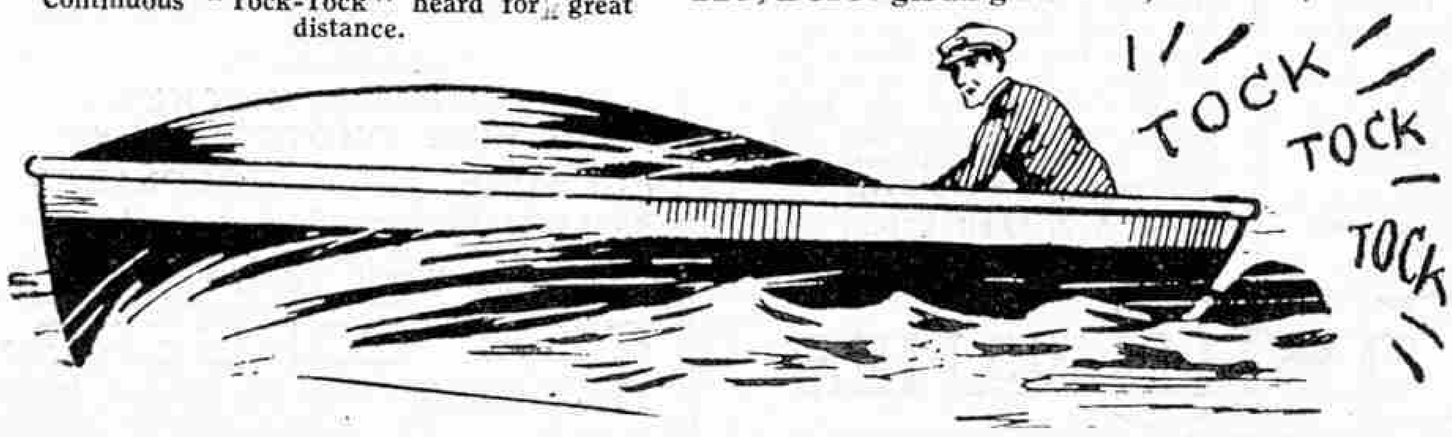

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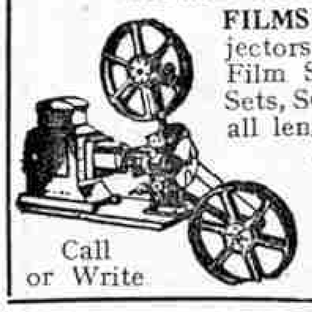

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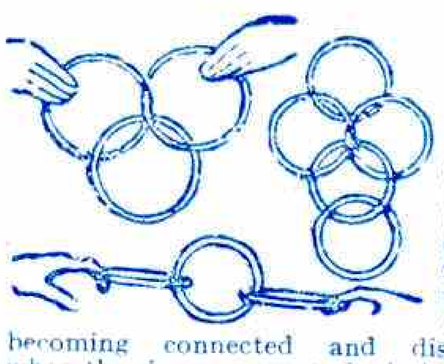
GAMAGES

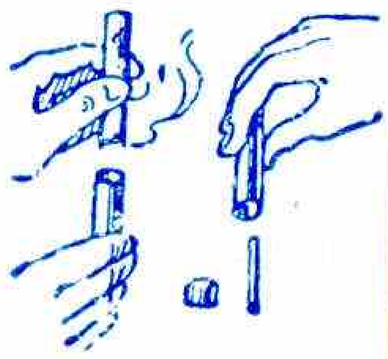
Grand Display of the Most Modern and Fascinating Tricks, Novelties, etc., for Meccano Boys

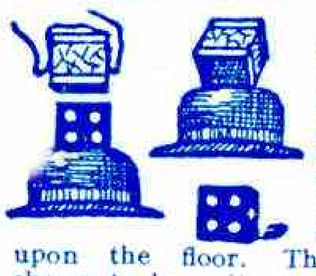
Amongst the 1000 and 1 things Gamages sell we make it an outstanding speciality of supplying the Amateur Conjurer—there is no store other than Gamages that carry such huge and comprehensive stocks, and certainly at the lowest prices—order from this Page or write for the Catalogue post free, on application.



The Celebrated Japanese Ring Trick. The rings are proved to be solid and are handed round for examination, but at the command of the performer they become linked together in chains of two, three, or more, and yet continually keep becoming connected and disconnected. Finally, when the rings appear to be in inextricable confusion, they suddenly disentangle and fall upon the floor. Price, complete with full instructions. **2/9** and **5/9** Post 4d. **3/9**

Disappearing Cigarette in Case.
A cigarette is dropped in metal case and lid placed on it; it is then given to a spectator to hold; the cigarette is now discovered elsewhere; upon the case being opened and examined by audience cigarette is found to have disappeared, and there is a match in its place. Post 2d. **2/6**





The Wandering Die.
A solid die, after being inspected by the company, is placed on the crown of a borrowed hat. An examined cover just large enough to put over the die is then placed over the latter, which, upon command, passes through the hat and falls upon the floor. The cover is shown to be quite empty.
Price, complete. Post 3d.
Large professional size. Price **4/6**,
Small size **1/-** and **1/6** Post 3d. **2/6**

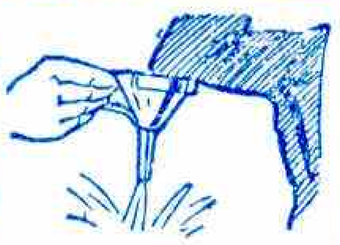
The Magic Box and Ball.
The ball is taken out of the box, concealed in the pocket and the box closed; the ball is commanded to reappear in the box, where it is seen when opened. Again the box is closed and the ball caused to appear in back pocket, and the box shown empty again.
Price, complete with full instructions.
Large size. Price Post 3d. **2/6**
Smaller sizes. Prices **1/-** and **1/6**

Easy Conjuring without Apparatus.
The book of the year. You cannot afford to be without it. Shows you how to perform hundreds of tricks easily with cards, handkerchiefs, coins, paper, matches, etc., etc. No apparatus required. Be the envy of all your friends at this year's Christmas party and blossom forth as an amateur conjurer.
Price Post 3d. **2/-**

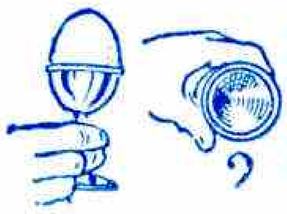
Gamages celebrated Boxes of Conjuring Tricks.
An ideal Xmas Gift for a boy. Amuses for hours. Complete with full instructions. **3/-**
Prices **4/6** (Post 3d.), **7/9, 10/9, 15/9** (Post 6d.), **22/6, 35/-, 42/-, 63/-.**

The Gamage Water Pistol.
Just the present the young boys love. Quite harmless. Throws a spray of water quite a long distance. **2/-** Post 3d.

The Mysterious Funnel.
This wonderful funnel, although apparently in every way ordinary, produces water whenever required. You can place it under the elbow and out comes the water, or at back of head or feet. Very funny effect. Post 3d.
Full instructions.

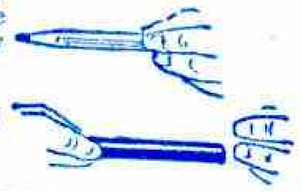


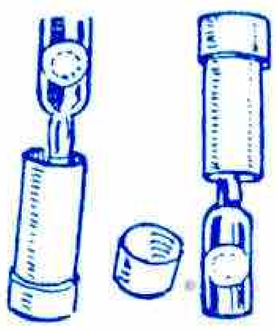
Prices **1/3** and **1/6**



The Disappearing Egg.
Quite a novelty. An egg mysteriously vanishes from the egg cup and then as mysteriously comes back again. No skill required. Price Post 2d. **1/6**
Full instructions.

Colour Changing Pencil. A very novel and pretty little pocket trick. A blue pencil is shown and held at the finger tips. Upon the performer passing his hand over it the colour changes to red. Very simple. Price, with instructions. Post 1½d. **1/-**





The Upside-Down Bottle.
A miniature bottle is placed in a brass tube, upside down and covered with lid. When bottom lid is taken off and tube removed bottle is found to be right side up, having apparently turned right over whilst in tube. Very clever effect. How is it done? No skill required. Price Post 2d. **1/6**

Magic Dagger Joke.
You pretend to stab yourself or someone else (and it looks most realistic), but you are not injured in any way. The blade slides into the hilt. Price Post 2d. **1/-**

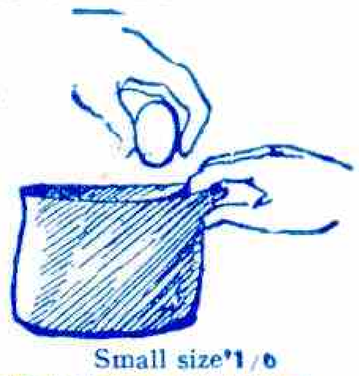
The Obedient Ball.
A large wooden ball with a hole in it, through which is threaded a piece of cord. The ball runs easily both ways, but at command it suddenly stops in the middle or at any place desired. Price with full instructions. **1/6**

Post 3d. Small size, Price **6d.** Post 2d

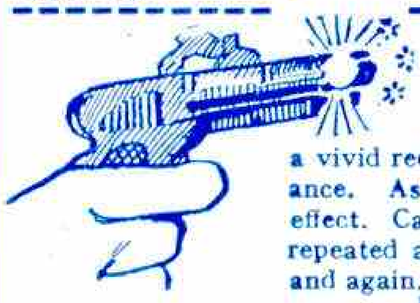
The Latest Colour Change.

Three silk handkerchiefs are exhibited, both hands are shown empty with the exception of the silks. Now, by simply pulling them through the hand, the three handkerchiefs change colour, and what is the marvellous part of the trick is that the colour does not change until the hand has passed over the silk, that is, the handkerchief is red where it hangs from the bottom of the closed fist and green above the fist. Yet the hands are again shown empty. Price, complete with full instructions. Post 3d. **3/6**
Small single colour change **1/6**

The Celebrated Egg Bag Trick.
By the aid of this wonderful bag an egg is made to mysteriously vanish, and after the bag being turned inside out several times to prove it contains nothing, and everybody is satisfied the egg is no longer in the bag, the performer again commands the egg to make its appearance. Price Post 2d. **2/6**



Small size **1/6**



The Pirate's Pistol.
Most realistic. The novelty of the year. When trigger is pressed a vivid red flash makes its appearance. As illustrated. Wonderful effect. Can be repeated again and again. Price Post 2d. **1/6**

Whirligig Puzzle. The centre of this Whirligig Puzzle revolves. There are upon its surface four holes into which to accomplish puzzle it is necessary to get four small plated balls. Of course, it is possible, but requires a deal of patience. Price Post 2d. **1/-**

Gamages Wonderful Box of All-Metal Puzzles.
Contains complete set of Metal Puzzles. Amuses for hours, splendid value. Small size. Price **1/6**
Post 2d. Large size. Price **3/-**. Post 3d.

A. W. GAMAGE LTD., HOLBORN, LONDON, E.C. 1

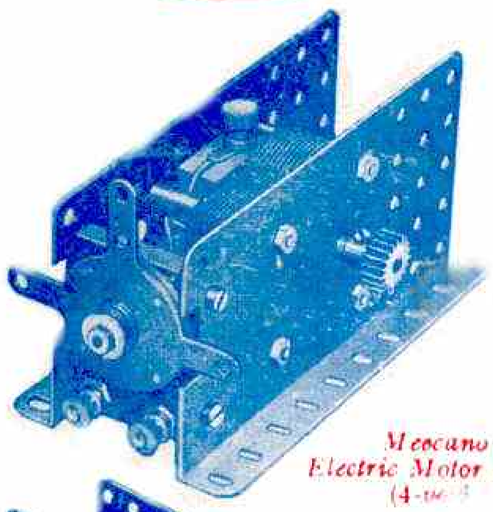
Run your Meccano models with Meccano Motors

RELIABLE — POWERFUL — SPECIALLY DESIGNED TO BUILD INTO THE MECCANO SYSTEM

If you wish to obtain the fullest possible enjoyment from the Meccano hobby you should operate your models with a Meccano Motor. Just imagine the thrill of setting in motion your Crane, Ship Coaler, Motor Car, Windmill or any other model you build. You push over the control lever of the Motor and immediately the model commences to work in exactly the same manner as its "big brother" in real life.

All Meccano Motors are strongly made and the utmost care is taken in their manufacture to ensure that they give every satisfaction to their owners.

Particulars and prices of the Motors and Accessories are given below.



Meccano Electric Motor No. 1 (4-volt)

Meccano Electric Motor No. 2 (100-250-volt A.C. or D.C.)

MECCANO CLOCKWORK MOTOR

This is a splendid piece of mechanism, simple, powerful, reliable and free from all danger. It is fitted with starting, stopping and reversing levers, and all its movements are fully explained in the instructions that accompany it. Price **7/6**

MECCANO ELECTRIC MOTOR No. 1

(4-volt)

The 4-volt Motor is specially designed to build into Meccano models. It may be run by a 4-volt accumulator or, by employing the Transformer described in the next column, from the main. Fitted with reversing motion, provided with stopping and starting controls, and the gearing is interchangeable.

Price **15/6**

MECCANO ELECTRIC MOTOR No. 2

(100-250-volt A.C. or D.C.)

This Electric Motor may be employed for any purpose for which a small motor is suitable, but it is specially adapted for driving Meccano models, into which it may be built. It is designed for connection with the electric light main—100-120-volts or 200-250-volts, alternating or direct. A 6 ft. length of flex, fitted with a plug for connection with the motor terminals and an adapter for connection with an ordinary lamp socket, is included. A suitable resistance is required when the motor is run with a 200-250-volt current, and this is supplied by connecting a 60-watt lamp in series with the motor. A board, on which are mounted a suitable lamp holder (lamp not included) and a switch, is provided separately.

Price **32/6**

Lamp board (with lamp holder and switch) Price 4/6

MECCANO RESISTANCE CONTROLLER

By employing this variable resistance the speed of the Meccano Electric Motor No. 1 (4-volt) may be regulated as desired. The controller is connected in series with the motor and accumulator, or with the motor and transformer if a transformer is used as the source of power. It will not regulate the speed of a high-voltage motor connected to the main. Price **3/6**

TRANSFORMER

By means of this transformer the Meccano Electric Motor No. 1 (4-volt) may be driven from the house supply (alternating current only). It is available for all standard supply voltages, from 100 to 250 inclusive, at all standard frequencies. The supply voltage and frequency must be specified when ordering. Price **30/-**

MECCANO ACCUMULATORS

These new and excellent types of accumulators have been adapted to drive the Meccano Electric Motor No. 1 (4-volt). They have remarkable recuperative powers, and will continue to supply current when nominally exhausted.

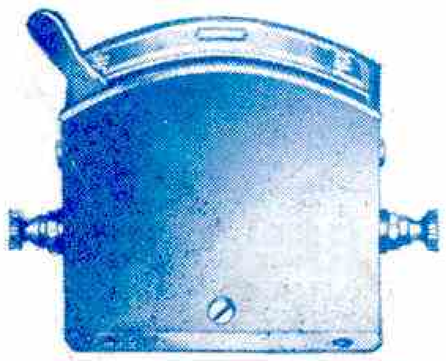
4-volt 8 amps Price **17/6** 4-volt 20 amps Price **25/-**

MECCANO RHEOSTAT

(For high voltage motors)

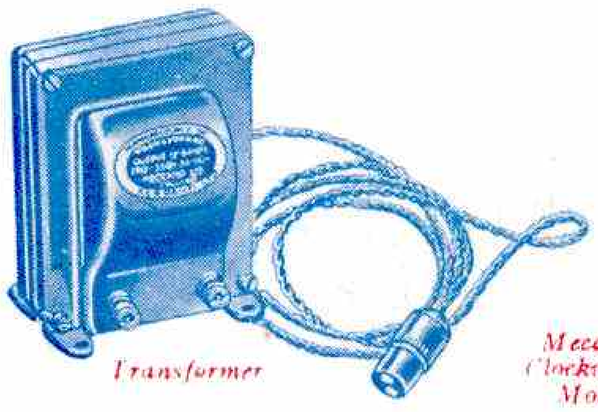
This Rheostat is for controlling the speed of the Meccano Electric Motor No. 2 or the H.V. Metropolitan Train. It may be connected to the house lighting system by means of an adapter and may be used with either alternating or direct currents ranging from 100 to 240 volts. A 60-watt lamp (not supplied) is required for use with the Rheostat.

Price **18/6**

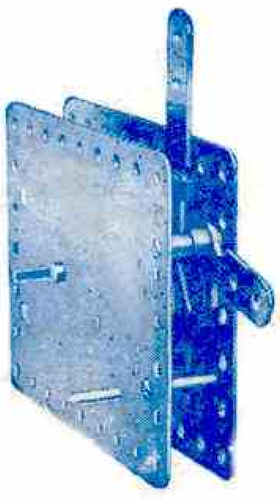


Meccano Resistance Controller

Meccano Rheostat



Transformer



Meccano Clockwork Motor

MECCANO LIMITED BINNS ROAD LIVERPOOL

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